the OIL AND GAS JOURNAL

NOVEMBER 19, 1956

API NUMBER

Drilling Costs ..... Weather Forecasting .....
Radiological Safety ..... 104 Octane Un
Texas Oil Formations ..... Hydraulic M
Venezuelan Cycling Project ..... Fiel
Supply of Tubular Goods ..... Costi

Middle East Crisis Turns Spotlight on Gulf Coast

p. 142

Lessons From Whiting Disaster

p. 132

NEWEST, FASTEST FROM LANE-WELLS

KWIK-KONE

another new development from Lane-Wells, makes it possible to shoot your longest zones on one run. Straddle unwanted zones and shoot just the productive ones. KWIK-KONE does it because it can be custom-loaded and made up, in practically any length, right at your well. A fast, time-saving, tailor-made Koneshot perforator.

So, whatever your shooting zone—no matter how long—new KWIK-KONE can do it. Call your Lane-Wells man today—he has the full story.

LANE WELLS COMPANY

LANE-WELLS CANADIAN CO. IN CANADA
PETRO-TECH SERVICE CO. IN VENEZUELA

Write for complete KWIK-KONE information to > P. O. Box 1664, Houston 1, Texas

A Glance Ahead . . . at press time

These trends will make TOMORROW'S NEWS

Three tool pushers on a rig will not be too preposterous if drilling contractors don't heed present unionizing efforts.

Union organizers now starting a fresh campaign in the drilling part of the business are going to concentrate on signing up the driller. If the driller joins, chances are the crew will join, also. But under most contracting company setups, the driller is a supervisor and functions as part of management.

If the drillers on a rig go union, they can no longer be regarded as supervisors. Extra tool pushers, one on each tour, then will be needed to look after company interests. Giving the driller a feeling of being part of management and a permanent part of the organization may be necessary to preserve the present personnel system.

Some results are coming in on kaolin catalyst for moving-bed cracking units. Some refiners are gradually filling up their units with the new catalyst. They report improved octane and higher throughput rates.

Another octane increase in gasoline marketed in the Middle West can be expected by next spring. The pressure of new car models, with higher compression ratios and requirements, plus hot competition will keep the octane race warm. The Midwest has lagged behind the Gulf and East Coasts in octane number of gasoline.

Star Oil Co., which has won concessions in Venezuela, promises to remain a mystery in the industry for a while.

Authoritative sources say the only known financial backing at present is that of the Du Pont interests. But the company has approached several domestic companies with proposals for an interest in the Venezuelan operation. Two principal figures in the company are Joseph Davidson, Washington attorney, and Eric Johnston, head of the Motion Picture Producers Association.

Is a breakthrough coming on isomerization? Some think so. There may be some news within the year on low-pressure operations with nonmetal catalysts on a once-through basis. If this happens, it may bypass a major cost item—fractionation. Meanwhile, several workable processes are available for licensing—when refiners need them.

West Coast Pipe Line Co. has made headway in recent months in its long fight to build a crude-oil trunk line from West Texas to California. But it now appears stymied again.

The prime obstacles for years had been lack of sufficient financing and a dearth of West Coast markets. Surprisingly enough, a large enough source of West Texas crude now is reported to be the biggest block. Reliable reports are that West Coast Pipe Line had arranged to market products on the coast, largely fuel oil, via a deal with large retail chain. Several shut-down topping plants in the Los Angeles area would be reactivated to refine the oil.

Along with this, West Coast is reported to have finally obtained some financial backing from the trust fund of the potent teamsters' union. Options which the company once had with New Mexico for buying its royalty oil, however, have expired. And negotiations with West Central Texas producers for about 25,000 bbl. to go through the line have broken down. The producers balked at a proposed 10-year contract calling for sale of the West Texas oil at the California posted price.

the OIL AND GAS JOURNAL

NOVEMBER 19, 1956 • VOLUME 54 • NUMBER 81

THE STAFF

TULSA OFFICE
211 South Cheyenne Ave.
Phone Diamond 3-6291

Kenneth B. Barnes ..... Editor
Henry D. Ralph ..... Chief Editorial Writer
Ted A. Armstrong ..... News Editor
Gerald L. Farrar ..... Engineering Editor
Dr. Frank J. Gardner ..... Exploration Editor
Paul Reed ..... Pipeline Editor
John C. Reidel ..... Petrochemical Editor
C. O. Willson ..... Consulting Editor
W. L. Nelson ..... Technical Editor
Lynn M. Nichols ..... Presentation Editor
John C. Casper ..... Economics Editor
Neil Williams ..... Associate Editor
Norman S. Morrisey ..... Drilling-Development Editor
Gene T. Kinney ..... Assistant Pipeline Editor
R. B. Tuttle ..... Equipment Editor
Bill Linville ..... Assistant to Presentation Editor
Carl Hoot ..... District Editor
Carl J. Lawrence ..... District Editor
John C. McCaslin ..... District Editor
W. A. Bachman ..... District Editor
J. O. Scott ..... District Editor
J. C. Bradford ..... District Editor
Robert B. Bizal ..... District Editor
Sara Bangert ..... District Editor
LaWanda Turner ..... Readership Research
Helen Brown ..... Editorial Assistant
Alice Burt ..... Editorial Assistant
Aileen Cantrell ..... Editorial Assistant
C. Dudley Johnston ..... Art Director
Jo Jeanne Speaker ..... Staff Artist

NEW YORK OFFICE
500 Fifth Avenue
Phone LOngacre 4-6160

George H. Weber ..... Refining Editor
Paul Swain ..... International Editor
Ray G. Gibson ..... District Editor
John P. O'Donnell ..... District Editor

HOUSTON OFFICE
802 Sterling Building
Phone CApitol 4-7726

Larry Reser ..... District Editor
Ed McGhee ..... District Editor
Joe Reilly ..... District Editor

DALLAS OFFICE
1238 Mercantile Bank Building
Phone STerling 3074

Robert J. Enright ..... District Editor

LOS ANGELES OFFICE
650 South Grand Avenue
Phone VAndike 0722

D. H. Stormont ..... District Editor
William T. Smith ..... District Editor

WASHINGTON OFFICE
621 Albee Building
Phone District 7-1710

Bertram F. Linz ..... District Editor

Correspondents at Denver, Pittsburgh, Calgary, Columbus, Ashland, Ky., Oil City, Pa., Mount Pleasant, Mich., Melbourne, Australia; Regina, Sask.; Chatham, Ont.; Casper, Wyo., and Anchorage, Alaska.

The Oil and Gas Journal, Published Mondays, copyright 1956, by The Petroleum Publishing Co. Entered as second-class matter September 1, 1910, at post office at Tulsa, Okla., under act of March 3, 1879. United States and foreign rates to the petroleum industry, 1 year $4, 2 years $7, 3 years $8.

IN THE NEWS

A.P.I. Coverage

Need for Public Trust Is Dominant A.P.I. Theme 126
Pipeliners View Middle East Crisis at A.P.I. 127
Oil's Public Relations to Stress Good Citizenship 128
Frank Porter Takes a Look at Industry's Problems 129
Independent Refiners Want Place in Emergency Plans 129
Streamlined Reports Clear Up Picture at Conoco 130
Whiting Explosion Report May Launch New Safety Concept 132
Three New Vice Presidents Elected by A.P.I. 133
Economist Sees Total Demand Gaining Through 1962 135
Expert Claims U. S. Has Abundant Long-Range Reserves 136
Asphalt Demand Expected to Double by 1964 137
Lacey Walker Heads for Partial Retirement from A.P.I. 137
It's Pay-Out Time For Offshore Operations 138

General Interest:

Middle East Crisis Touches Many Oil Fronts 142
Harry F. Sinclair Is Dead 145
Deals for 31 Tankers Are in the Making 146
Government Says Oil Scouts Come Under 40-Hour Week 146
West Central Texas Operators Face Many Problems 148
Universe Leader Docks with 557,480 Bbl. of Crude 150
Clearing Suez Canal May Take Months 153

Pipelines:

New Pipeline-Coating Process Goes to Work 140
Pipeline Briefs 151
North Sea Terminus Picked for West German Line 152

Processing:

Jefferson Chemical Maps Big Expansion at Port Neches 147
Processing Briefs 149
Second Ethylene Plant Scheduled in Ohio Valley 151

Exploration:

Checkerboard Leasing May Be Followed Off California 141
Sahara Reserves Set at Seven Billion Barrels 152
Kansas Independent Gets Panamanian Concession 152
Arkansas Proves a Point 361
Montana Boasts Fabulous Oil Reserves 362

OIL AND GAS PIPELINES • REFINING • PETROCHEMICALS
EXPLORATION • DRILLING • PRODUCTION • FIELD PROCESSING
. . . an integrated magazine serving an integrated industry

SPECIAL A.P.I. SECTION

Drilling Costs Flatten Out at 1950 Levels **154**
By Douglas Ragland

Dry-Gas Cycling Yields 10,600 Bbl. Daily for Mene Grande **160**
By Kenneth E. Hard and Jack R. Wiewall

WEATHER IN THE PETROLEUM INDUSTRY **174-199**

Reducing the Odds in Weather Betting **174**
By Charles Pennypacker Smith

Degree-Day Forecasting Needed in The Petroleum Industry **185**
By W. J. Sweeney

When Will We Have Reliable Long-Range Forecasting? **191**
By Hurd C. Willett

Weather Forecasting Will Improve **198**
By Archie M. Kahan

Radiological Safety in The Petroleum Industry **200**
By B. A. Fries

Casing and Tubing for Tomorrow's Drilling **208**
By H. W. Ladd

Place of The Engineer in Petroleum-Industry Buying **212**
By John W. Parks

New Model Forms for Unit and Unit-Operating Agreements **217**
By H. F. Beardmore

Latest Information on Texas Oil-Producing Formations **220**
By Frank E. McGonagill, Jr.

New Exploration Tool: The Continuous Velocity Log **224**
By Eric M. Denton

New Cosden Unit Makes 104 Octane **238**

A Look at Hydraulic Rich-Oil Motors **245**
By B. J. Thompson

Venezuelan Natural Gas for U. S.? **255**
By John D. Crecca

The Foreman's Page **258**

Field Processing **260**

The Refiner's Notebook **263**

Costimating **265**

New Seismic Technique for Difficult Areas **267**

Pipeline Patrol: Loads Determine Compressor Requirements **273**

DEPARTMENTS

A Glance Ahead	1	Engineering Reference Section	258	Exploration Highlights	361
They Say	110	Foreman's Page	258	Personals	397
Calendar of Events	116	Field Processing	260	Statistical Summary	400
Journally Speaking	121	Refiner's Notebook	263	Drilling Statistics	401
Editorial	123	Cost-imating	265	Refining Statistics	402
This Week	125	Drilling Contractors	269	Markets	403
Watching Washington	147	Pipeline Patrol	273	Classified Advertising	405
International News	152	Equipment Men in News	335	Advertisers' Index	411

NORRIS

GREAT BEND

CORPUS CHRISTI

HOUSTON

KILGORE

ODESSA

WICHITA FALLS

OKLAHOMA CITY

SALEM

CASPER

NORRIS QUALITY

OIL WELL SUPPLIES

W. C. NORRIS MFR. INC.
TULSA, OKLA.

To Better Serve You

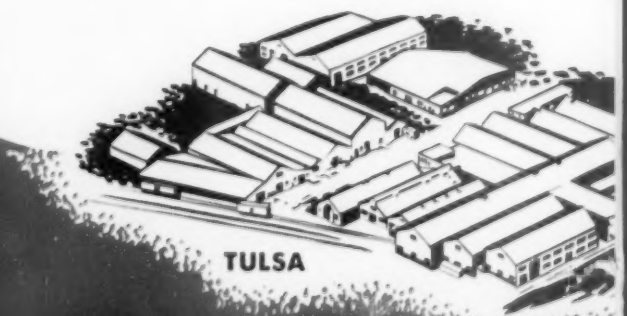
W. C. NORRIS MAINTAINS

WAREHOUSES

STRATEGICALLY LOCATED

TO SERVE

Your Supply Store



TULSA

Your SUPPLY STORE IS OUR DISTRIBUTOR

W.C. NORRIS MANUFACTURER, INC.

TULSA, OKLAHOMA

BRANCHES:

GREAT BEND, KANSAS; CORPUS CHRISTI
HOUSTON, KILGORE, ODESSA, WICHITA FALLS, TEXAS;

Since NORRIS 1882

OKLAHOMA CITY, OKLAHOMA
SALEM, ILLINOIS; CASPER, WYOMING;

WEST COAST DIST.: REPUBLIC SUPPLY CO. OF CALIF., LOS ANGELES

For every drilling need, you'll find a correct size and construction of Macwhyte line. Included in a thousand and one types and sizes of Macwhyte wire rope are Rotary Lines, Cable Tool Drilling Lines, Sand Lines, Winch Lines, Casing and Tubing Lines, for drilling, servicing, pipeline, or refinery equipment. Prompt shipment from stock.

These wire rope products
SAVE TIME AND MONEY

The ability of wire rope to serve you relies on the quality you buy and the selection of the proper material.

Because Macwhyte Company has a wide selection of quality products, you can be sure the sling, wire rope, or wire rope assembly you buy meets the needs and service conditions of *your* equipment, and is designed to give outstanding service at low operating cost.

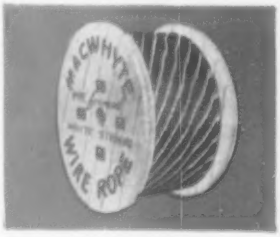
Your Macwhyte distributor will give you prices, literature, and catalogs, and can supply you promptly with standard or custom wire rope, cable assemblies, slings, aircraft cable, tie-rods, and swaged fittings.

MACWHYTE
WIRE ROPE · SLINGS · WIRE ROPE ASSEMBLIES

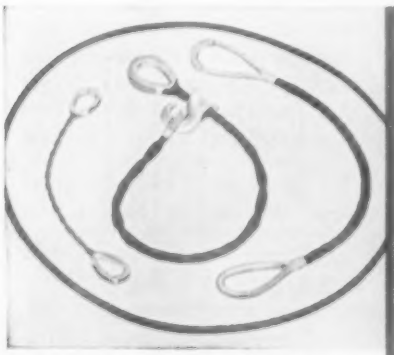
Macwhyte Company, 2916 Fourteenth Avenue, Kenosha, Wis.

Manufacturers of: Internally Lubricated PREformed Wire Rope, Braided Wire Rope Slings, Aircraft Cables and Assemblies, Monel Metal, Stainless Steel Wire Rope, and Wire Rope Assemblies. Special catalogs available.

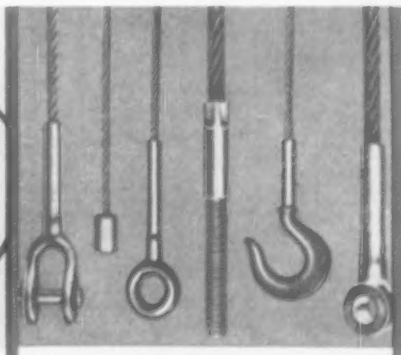
New York 4, 35 Water St.
Pittsburgh 19, 704 Second Ave.
Chicago 6, 228 So. DesPlaines St.
Detroit 3, 75 Oakman Boulevard
St. Paul 14, 2356 Hampden Ave.
Ft. Worth 1, P.O. Box 605
Portland 9, 1603 N. W. 14th Ave.
Seattle 4, 87 Holgate St.
San Francisco 7, 188 King St.
Los Angeles 21, 2035 Sacramento



Distributors conveniently located throughout the United States.



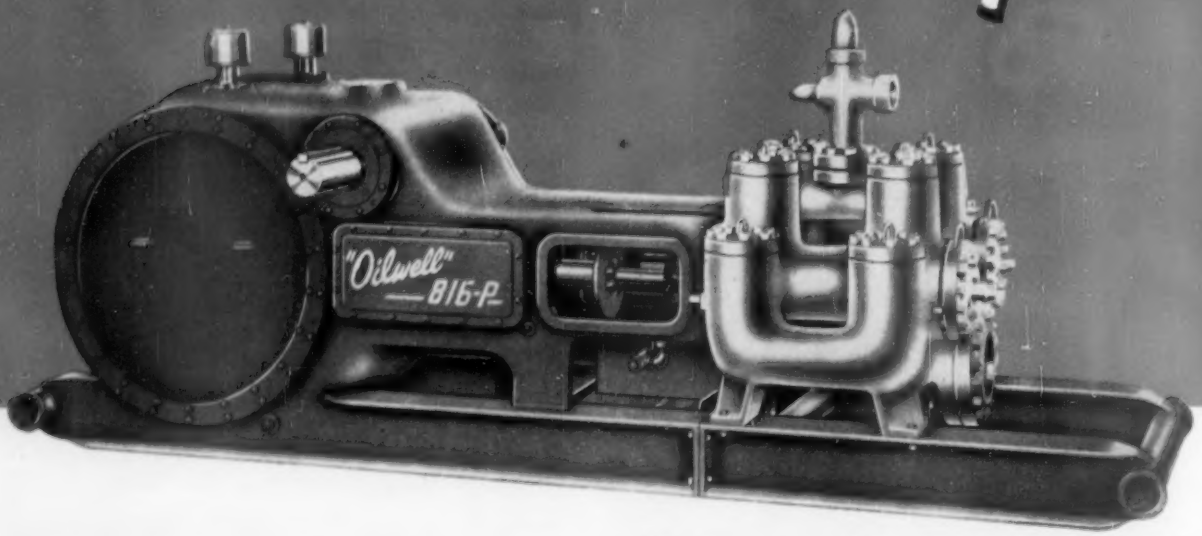
BRAIDED SLINGS. Hundreds of custom and standard designs in Round-Braided, Flat-Braided, Single-Part and Grommet slings are supplied for almost any material handling need. *Catalog S-8 gives complete information.*



WIRE ROPE ASSEMBLIES. Macwhyte Safe-Lock Wire Rope Assemblies are made to order in length, strength, and flexibility desired. Terminals are permanently attached to one or both ends. A wide selection of fittings are made in strengths from 500 to 85,000 lbs. and up. *Request Catalog 5601.*

WIRE ROPE. There are *a thousand and one* sizes and types of Internally Lubricated Macwhyte wire rope to give you the *right* rope for any equipment need. *Catalog G-16 lists all wire rope classifications and sizes, as well as general information on use and handling.*

Now . . . . the outstanding 816-P Mud Pump



This new 16" stroke pump, designed for high-pressure drilling, is a worthy companion to "Oilwell's" 818-P pump which has been enthusiastically received by drillers during the past three years.

The 816-P is conservatively rated 700 hp at 65 rpm* but weighs only 35,500 lbs.—less than 51 lbs. per rated horsepower. It gives you *more* pressure, *more* horsepower with *less* over-all weight than other types. And these advantages are yours in a *smaller* space.

The entire main bearing supporting structure is integral with the frame, forming a strong, rigid support for the working parts to resist heavy stresses at high-discharge pressures.

The double extended pinion shaft is only 6¾ ft. over-all, and permits twin drive when desired. Two-piece skid construction facilitates independent handling of fluid end when necessary. Fluid piston rod oiling system is standard equipment.

Ingenious mounting of alloy-steel crankpins directly in the crankshaft results in minimum crankpin overhang. Steel crossheads are equipped with shim-adjustable shoes, operating in replaceable lower guides.

Call your "Oilwell" representative for complete information about this newest available "Oilwell" pump.

Displacement (Piston Rod Deducted) and Horsepower Requirements

Piston Size (Inches)	Maximum Working Pressure (psi)	Gallons (per rev.)	Displacement gpm at pump speeds (rpm) of:					
			30	40	50	55	60	65*
8	1,197	13.11	393	524	655	721	786	852
7¼	1,280	12.24	367	490	612	674	735	796
7¼	1,478	10.61	318	425	531	584	637	690
7	1,593	9.85	295	394	493	541	591	640
6¾	1,725	9.10	273	364	455	500	545	591
6½	1,875	8.37	251	335	419	460	502	544
6	2,235	7.01	211	281	351	386	421	456
5½	2,725	5.76	173	230	288	317	345	374
Pinion Shaft—rpm			137	183	228	251	274	297
Brake Horsepower Required			323	431	538	592	646	700

*Higher speed and horsepower permissable with favorable suction conditions.

OIL WELL SUPPLY
DIVISION UNITED STATES STEEL CORPORATION

Executive Offices—DALLAS, TEXAS
Export Office—
30 ROCKEFELLER PLAZA
NEW YORK 20, N. Y.

Area Offices—
CALGARY, ALBERTA
CASPER, WYOMING.....COLUMBUS, O.
DALLAS, TEXAS.....HOUSTON, TEXAS
TULSA, OKLA.....LOS ANGELES, CALIF.

Branches Serving All Oil Fields

USS TRADE MARK

"OILWELL"

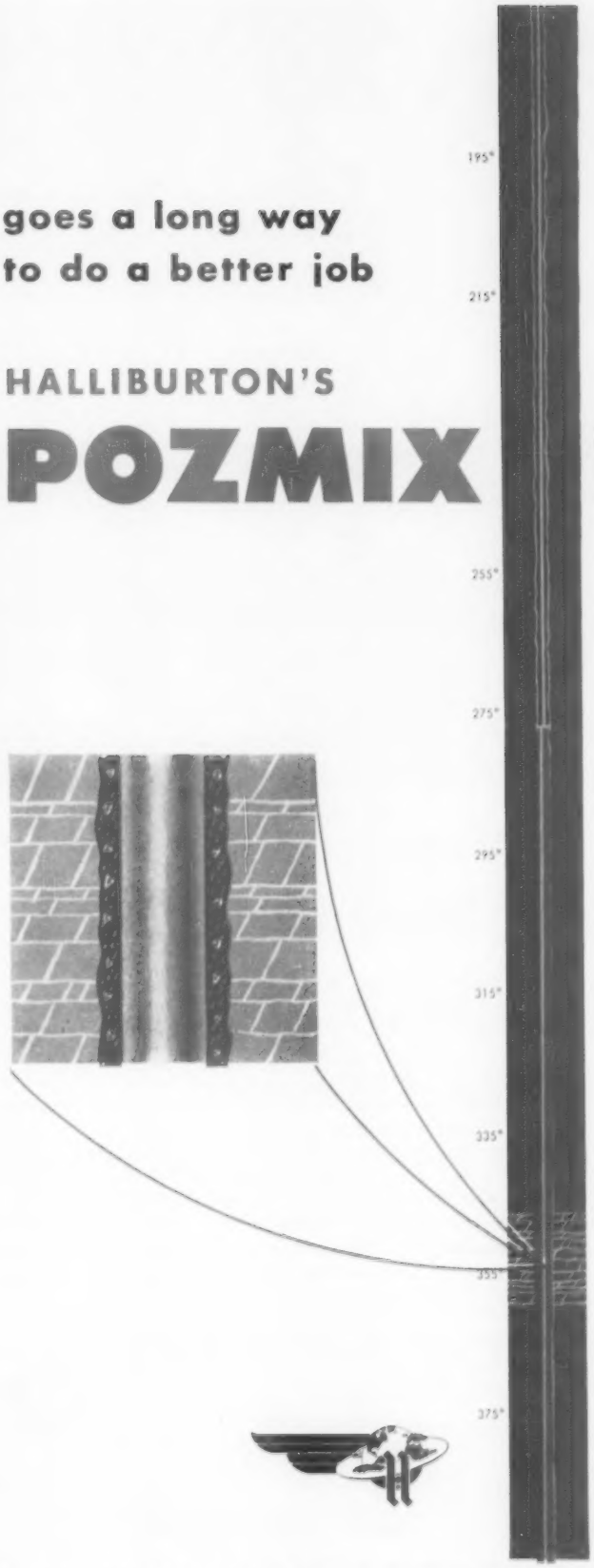
TRADE MARK

UNITED STATES STEEL

goes a long way
to do a better job

HALLIBURTON'S

POZMIX 140



With wells going four miles deep, cement must travel farther . . . and longer . . . to reach a destination where it's hotter and where pressures are higher. That calls for a cement that is "tailored" to suit these conditions . . . Halliburton's POZMIX 140 – the superior cement that goes a long way to do a better job . . . at lower cost.

Thickening Time Extended

POZMIX 140 gets off to a better start for a long trip because hardening is slow at atmospheric temperature and pressure. The effects of high temperature and pressure down the hole may be controlled by the addition of set control additives. The lower pressures encountered while pumping or displacing POZMIX 140 are due to a combination of lighter slurry weights and the characteristic of the spherical particles of the pozzolans which function as tiny ball bearings in the slurry.

No Retrogression Under High Temperature

POZMIX 140 does not retrogress in strength under extreme high temperatures. This allows waiting-on-cement time to be consistent with other cements and admixtures under the same conditions. When used at temperatures in excess of 140° F, POZMIX 140 has more than adequate strength to meet specified requirements for oil well cements. At early ages, it perforates with minimum shattering.

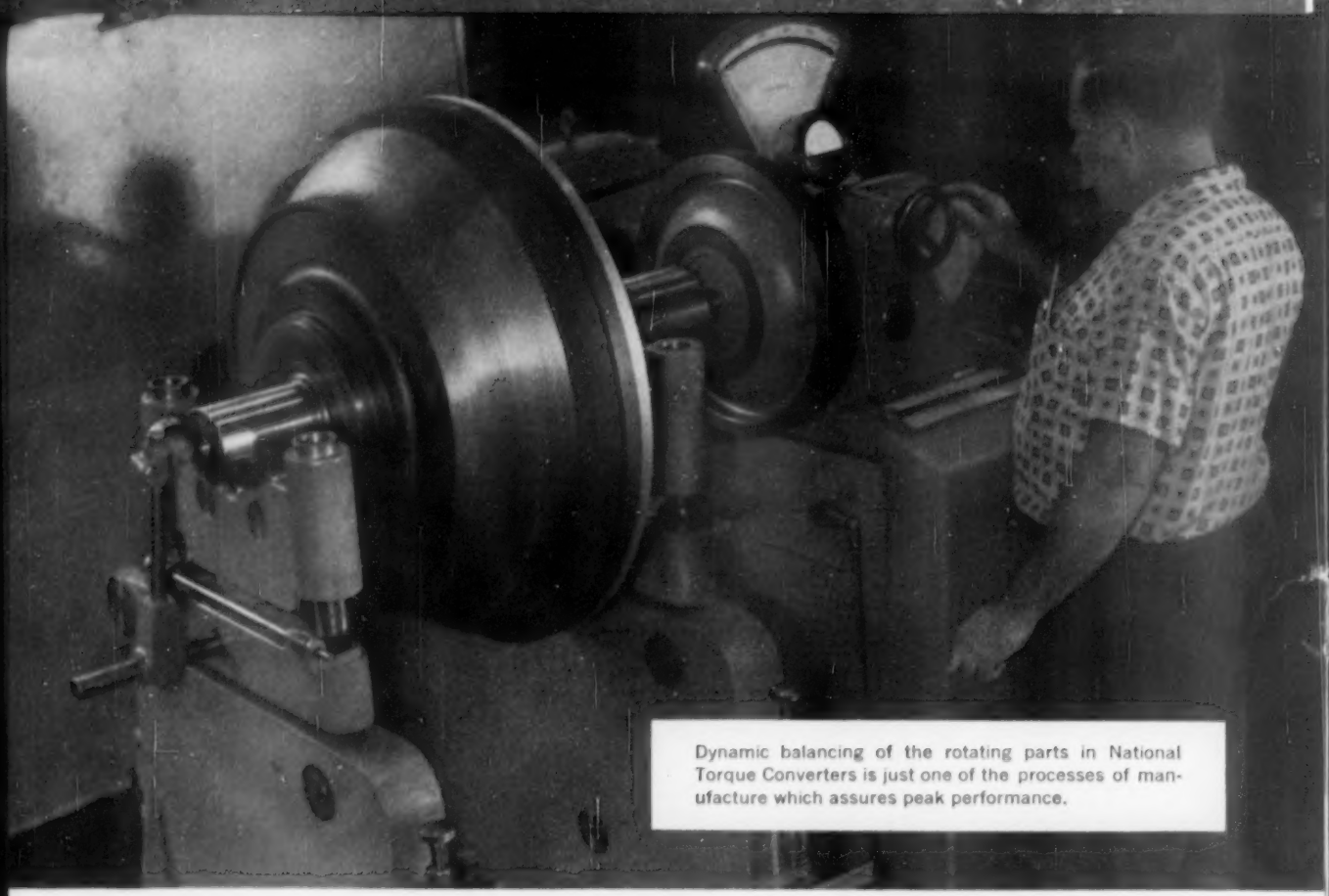
For successful cementing in deep, hot wells, you need a superior cement with the properties of POZMIX 140 . . . the cement that goes a long way to do a better job . . . yet actually costs less than conventional cement. Call your local or district office of the Halliburton Oil Well Cementing Company, Duncan, Oklahoma.

COMPLETE DATA SENT ON REQUEST

Get this valuable information for your Halliburton Service File

HALLIBURTON
CEMENTING SERVICES

251 SERVICE CENTERS—JUST MINUTES AWAY FROM ANY RIG



Dynamic balancing of the rotating parts in National Torque Converters is just one of the processes of manufacture which assures peak performance.

Dependable heavy-duty performance is engineered and built into National Torque Converters

Heavy machinery demands exceptional torque converter performance. Examples of this are earth-handling and excavating equipment, mining, and oil field drilling equipment.

To meet the most exacting service demands, in a wide variety of industrial applications, a full line of heavy duty National Torque Converters are available. These are designed and built with a broad range of performance characteristics and in horsepower ratings to match torque converter to prime movers of 100 to 1000 hp in virtually any application. The torque converters are engineered for the specific equipment application.

Precision fabrication of parts . . . exhaustive tests of component parts, of sub-assemblies, and of complete torque converters . . . assure long, trouble-free service of each National Torque Converter, with a minimum of attention from the operator and with minimum expense to the owner.

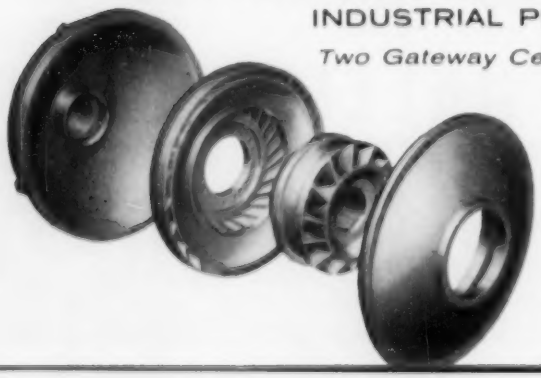
That means that when you select a National Torque Converter to match a specific engine or motor in a specific application, you can be sure of duplicate results from each succeeding National Torque Converter engineered and built to the same specifications.

National Supply engineers will gladly discuss National Torque Converters in relation to your equipment and make recommendations of exact size and torque capacity. Why not call on them?

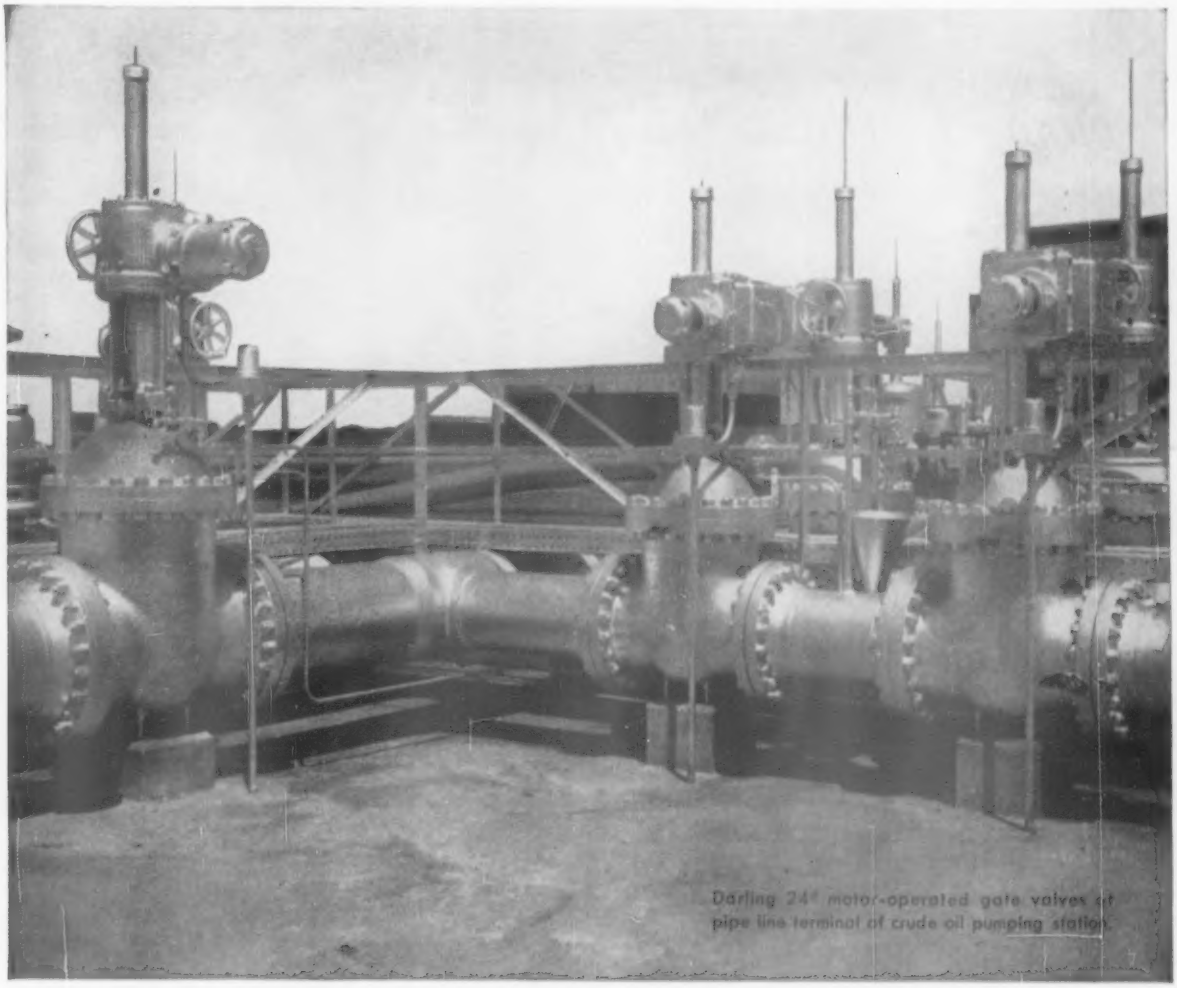
THE NATIONAL SUPPLY COMPANY

INDUSTRIAL PRODUCTS DIVISION

Two Gateway Center, Pittsburgh 22, Pa.



Pace-setters in the progress of industrial power transmission



Darling 24" motor-operated gate valves at pipe line terminal of crude oil pumping station

Why Darling gate valves work better...longer!

HERE'S the simple answer. There's little that *can* go wrong with Darling *fully revolving double disc, parallel seat gate valves.* This unique principle recognizes and thus *avoids* the common sources of valve failure . . .

Take seat misalignment for example. The Darling principle automatically compensates for this common cause of leaks! Then too, there's *uniform* distribution of disc-and-seat wear, positive relief of wedging pressure as discs unseat, and *easier operation* even under pressure and temperature extremes.

Finally, with these Darling gate valves that work better, longer, you naturally minimize down time and maintenance expense. Why not get all the facts on Darling gate valves of the proper size and type for your own service needs? We'll be happy to cooperate.

DARLING VALVE & MANUFACTURING CO.

Williamsport 1, Pa.

Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ontario

Now–the Plant You Dream about...

Maintenance-Free because of Aluminum

Here's Why:

Aluminum resists rust and corrosion due to chemicals, gases, plant atmospheres, and coastal environments. You save the expense of painting and enjoy the natural bright appearance of this long-lasting metal. You save on replacement of parts destroyed by corrosion.

Build with Aluminum Throughout

Aluminum Structurals give you strengths equal to structural steel with only ⅓ the weight. Ideal for framework and supports.

Aluminum Jacketing provides maintenance-free beauty plus the benefits obtained from natural insulation.

Aluminum Tread Plate is strong and lightweight, will not spark, resists rust and corrosion.

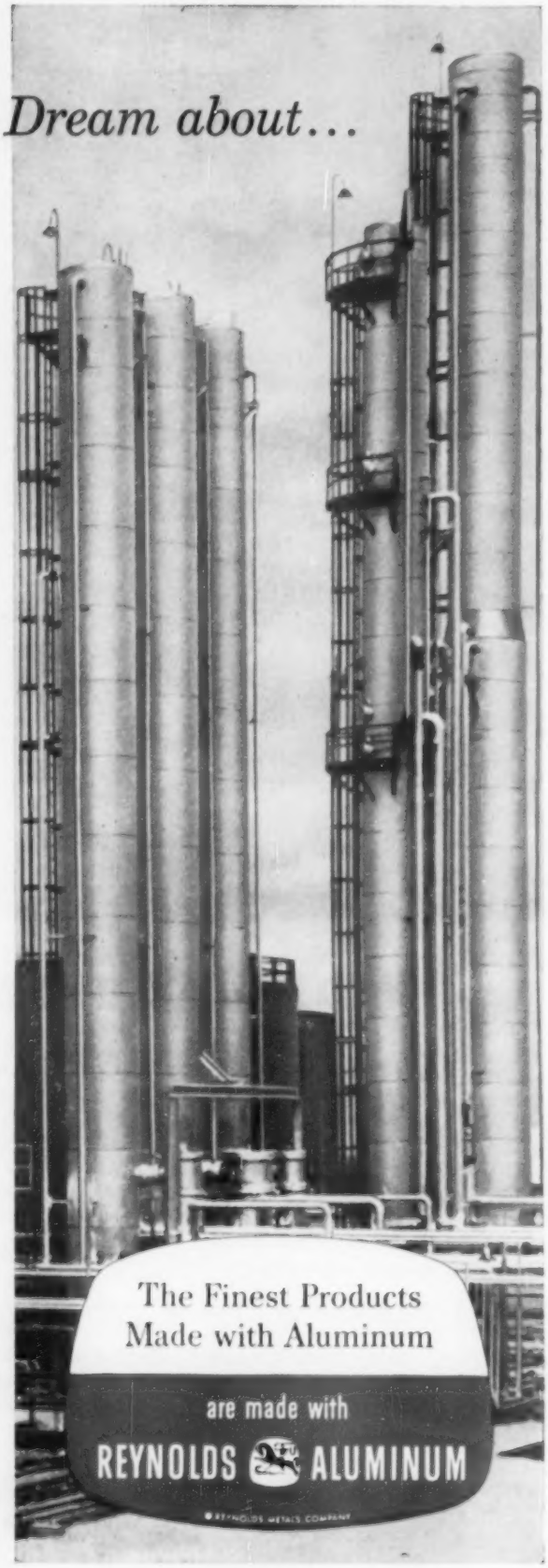
Aluminum Heat Exchanger Tubing offers lower initial cost, provides lower service costs.

Aluminum Accessories for gratings, railings, ladders and walkways.

Aluminum Process Pipe will not contaminate refined liquids and gases.

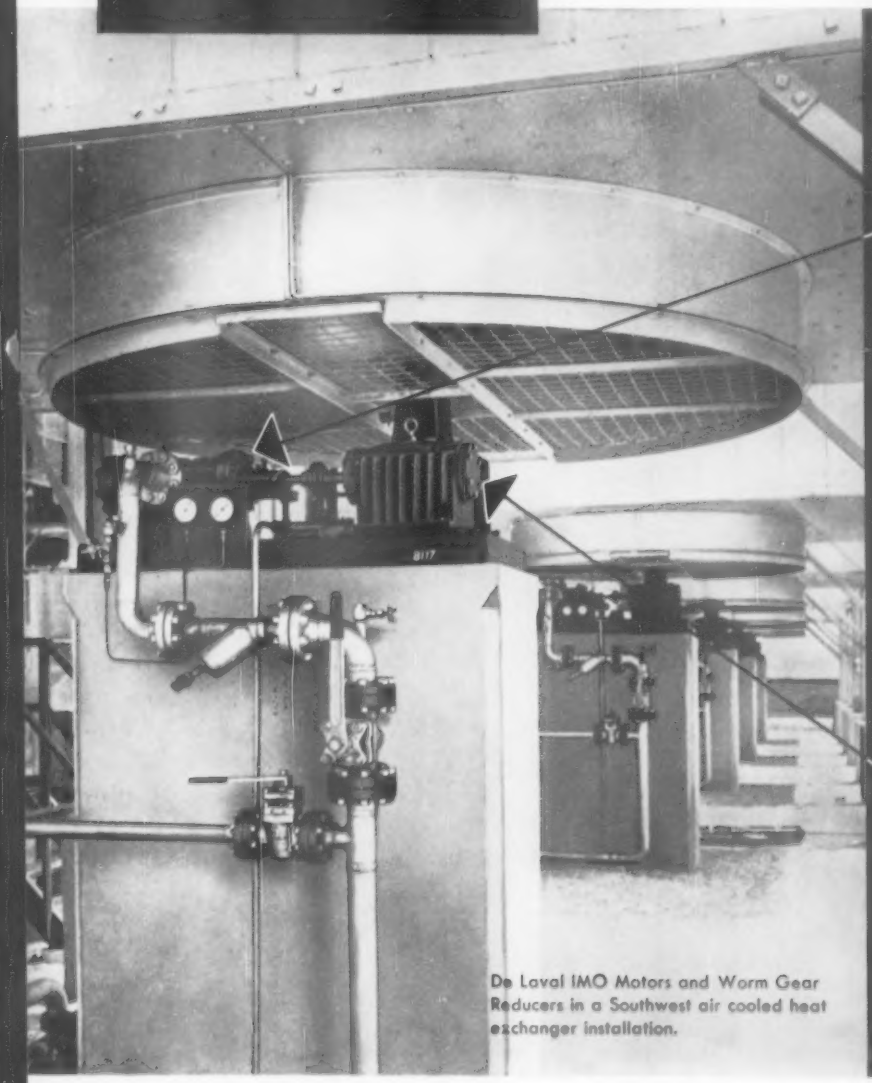
Get Complete Details Today

Call the Reynolds office listed under "Aluminum" in your classified telephone directory. Or write to *Reynolds Metals Company, P. O. Box 1800-CR, Louisville 1, Kentucky.*



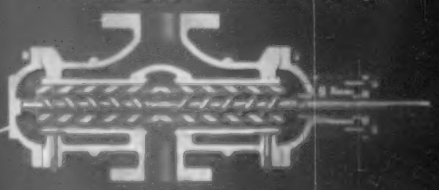
DE LAVAL
HYDRAULIC FAN DRIVES

do dependable, power-saving job in air-cooled cooling towers



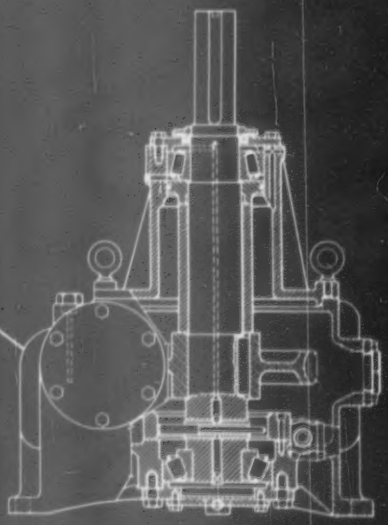
De Laval IMO Motors and Worm Gear Reducers in a Southwest air cooled heat exchanger installation.

De Laval IMO Motors and Pumps



simple, reliable, pulsation-free

De Laval Worm Gear Speed Reducers



ruggedly built for severe service

De Laval Hydraulic Fan Drives for air cooled heat exchangers and cooling towers *save power* since the fan operates at full speed only a portion of the time. Furthermore, there is no demand charge on hydraulic power. • Equally important, they provide *accurate, automatic* control of engine jacket water temperature, and also assure *complete operational flexibility*. Due to the simplicity of De Laval IMO motors and pumps as well as the rugged construction of De Laval Worm Gear Reducers, these units stay on the job for years. Both IMO motor and speed reducer are mounted and factory aligned on a single bedplate.

Investigate *all* the advantages of De Laval Hydraulic Fan Drives. Send for your copy of Bulletin 3009 which includes helpful performance data.

DE LAVAL *Hydraulic Fan Drives*

DE LAVAL STEAM TURBINE COMPANY

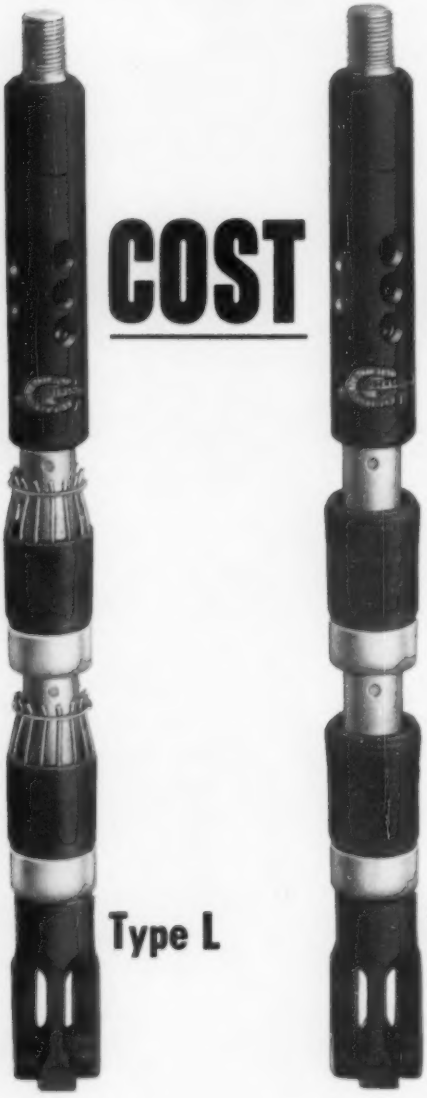
510 Nottingham Way, Trenton 2, New Jersey

DL370

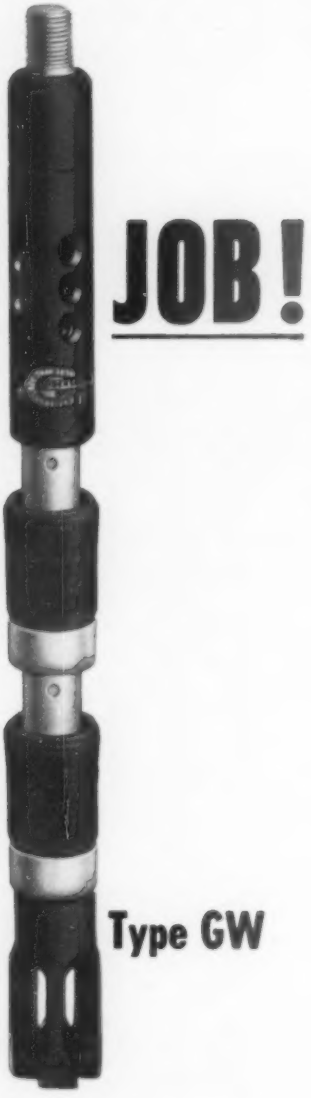
GUIBERSON SWABS DO A

GOOD LOW COST JOB!

GUIBERSON'S Type J



Type L



Type GW

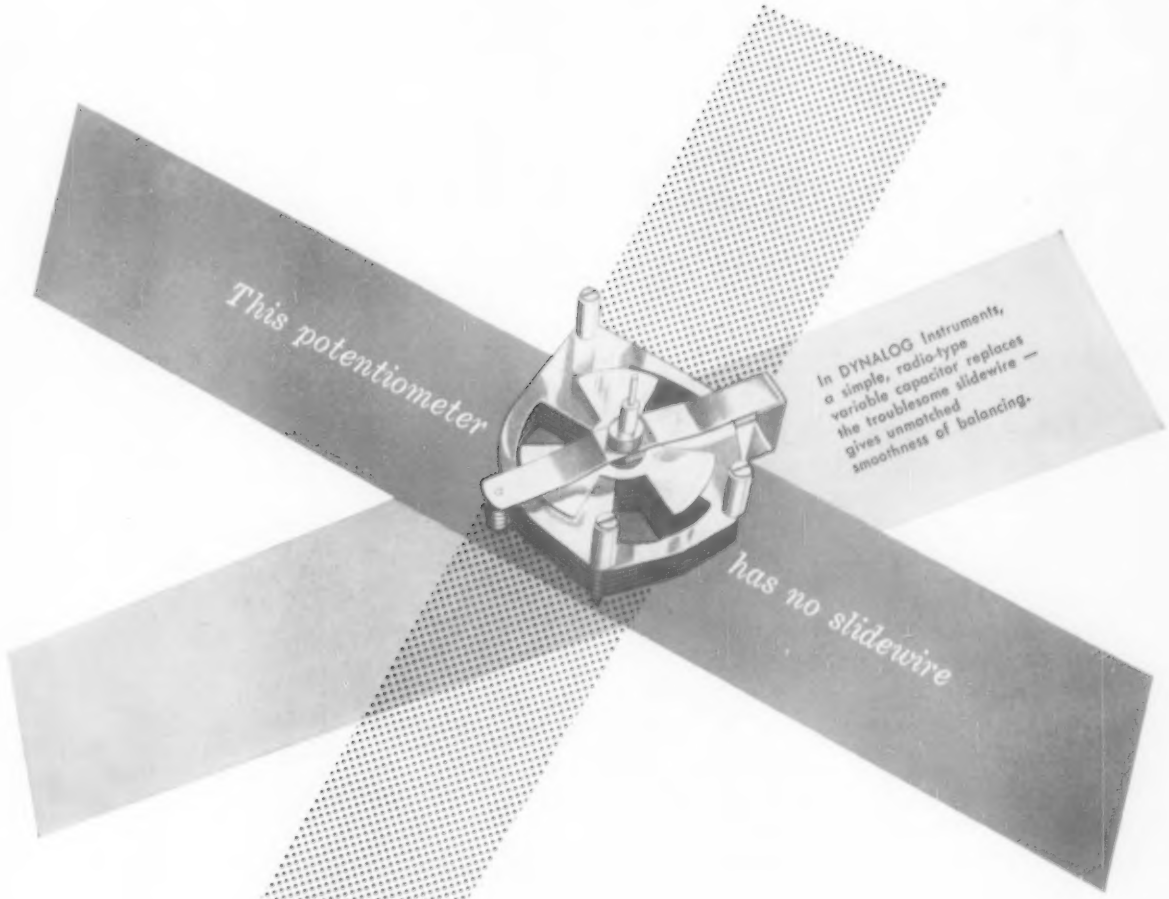
Here are three swabs capable of swabbing all sizes of tubing and drill pipe — in a minimum of time — making them most economical and efficient for routine swabbing. Many other types of Guiberson cups are immediately available for *specific* and *unusual* swabbing problems.

SAFE THAN SORRY BETTER BE — GUIBERSON

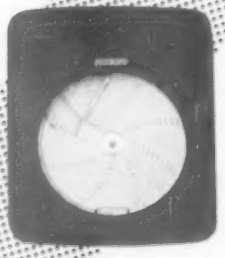
THE GUIBERSON CORPORATION

ESTABLISHED 1919
DALLAS, TEXAS
U. S. A.

Sold by
Oil Field Supply Stores
Everywhere


This potentiometer
has no slidewire
In DYNALOG Instruments, a simple, radio-type variable capacitor replaces the troublesome slidewire — gives unmatched smoothness of balancing.

STEPLESS CAPACITY-BALANCING
ELIMINATES STANDARDIZING!



DYNALOG'S EXCLUSIVE BALANCING ACTION

- no slidewire
- no batteries
- no standardizing
- no gears, cables, etc.
- no high-speed reversing motor

Here's the potentiometer that's *never* "off process" for standardizing. It requires none! The Dynalog's advanced, stepless-balancing design eliminates dry cell, provides *direct, uninterrupted* evaluation of the measured variable with sustained high accuracy.

Dynalog* design eliminates slidewire maintenance and motor servicing too! A simple, variable capacitor and positive magnetic drive provide smooth, continuous balancing action . . . instant response without wear. There are no fast-moving parts . . . no gears, cables, or complicated mechanisms. Only five moving parts, including the recording pen!

Dynalog Instruments are available for use with resistance, voltage, capacity, or inductive type primary elements to measure and/or control any process variable. For complete details, write for Bulletin 427. The Foxboro Company, 6011 Neponset Ave., Foxboro, Mass., U.S.A.

*Reg. U. S. Pat. Off.

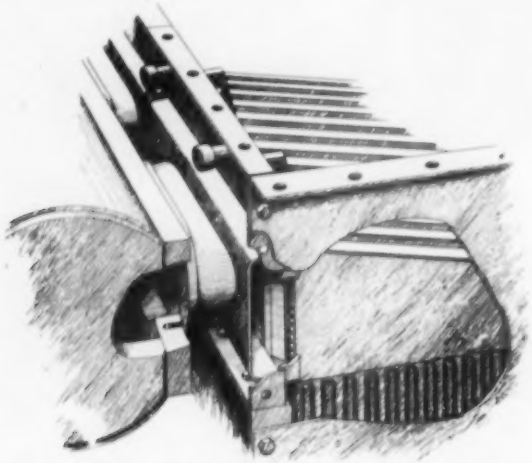
FOXBORO DYNALOG
Reg. U.S. Pat. Off.
ELECTRONIC INSTRUMENTS

how

a

PIN-FIN

extended-surface regenerator



Detail sketch showing specially designed 'pin-like' shapes which greatly increase heat-transfer surface area.

adds to economy of gas-turbine operation . . .

Compact, light-weight PIN-FIN Regenerator unit.

REDUCED FUEL CONSUMPTION is a principal reason. For example, a 75%-effective Air Preheater PIN-FIN Regenerator in a gas-turbine cycle at 6 to 1 pressure ratio and a turbine inlet of 1500 F, will cut fuel consumption by about 32%.
And, just as important, is the fact that these regenerators need practically no maintenance. That's been proved by five years of actual field service.
Get the complete story of what a PIN-FIN Regenerator can do for you – call or write the Air Preheater Corporation.

Mechanical Advantages of Air Preheater's PIN-FIN Regenerator...

- Compact
- Light-weight
- Quickly erected
- Minimum maintenance
- Convenient, one-unit design
- Easily disassembled

Air Preheater Corporation 60 East 42nd Street, New York 17, N. Y.

Pick a card ...any card

TWO DOZEN DIFFERENT NATIONAL TUBE ANALYSES:

Carbon	8 Cr, 1 Mo
Carbon, ½ Mo	9 Cr, 1 Mo
1 Cr, ½ Mo	12 Cr
1¼ Cr, ½ Mo	12 Cr, Al
2 Cr, ½ Mo	17 Cr
2¼ Cr, 1 Mo	18-8
2½ Cr, ½ Mo, ¾ Si	18-8 Ti
3 Cr, 1 Mo	18-8 Cb
5 Cr, ½ Mo	18-8 Mo
5 Cr, ½ Mo, 1½ Si	25-20
7 Cr, ½ Mo	3½ Ni
8 Cr, ½ Mo	5 Ni

• • • On it you'll find the answer to a certain refinery tubing problem. These 24 different steel tube analyses are the result of over 60 years of work and research in the refinery field. Each analysis has been developed to counteract specific refinery conditions ranging from corrosion to high pressures and temperatures. Each analysis has been tested again and again in actual refinery service so that our engineers know its exact capabilities and limitations. In addition to the two dozen analyses shown here, other chemical compositions are available in tubular products, and a wide variety of temperature problems are presently under study.

So pick a card—the analysis you think will meet your refinery tubing needs. But, to be sure before you order, contact us. We have a technically trained Mill Service Force available to you for technical and operating assistance in meeting your tubular requirements. This Force is also available for consultation in the field. We might be able to save you money by selecting a better alloy, at lower cost, to meet your problem. Service is as much a part of our business as is selling pipe. Let us hear from you.

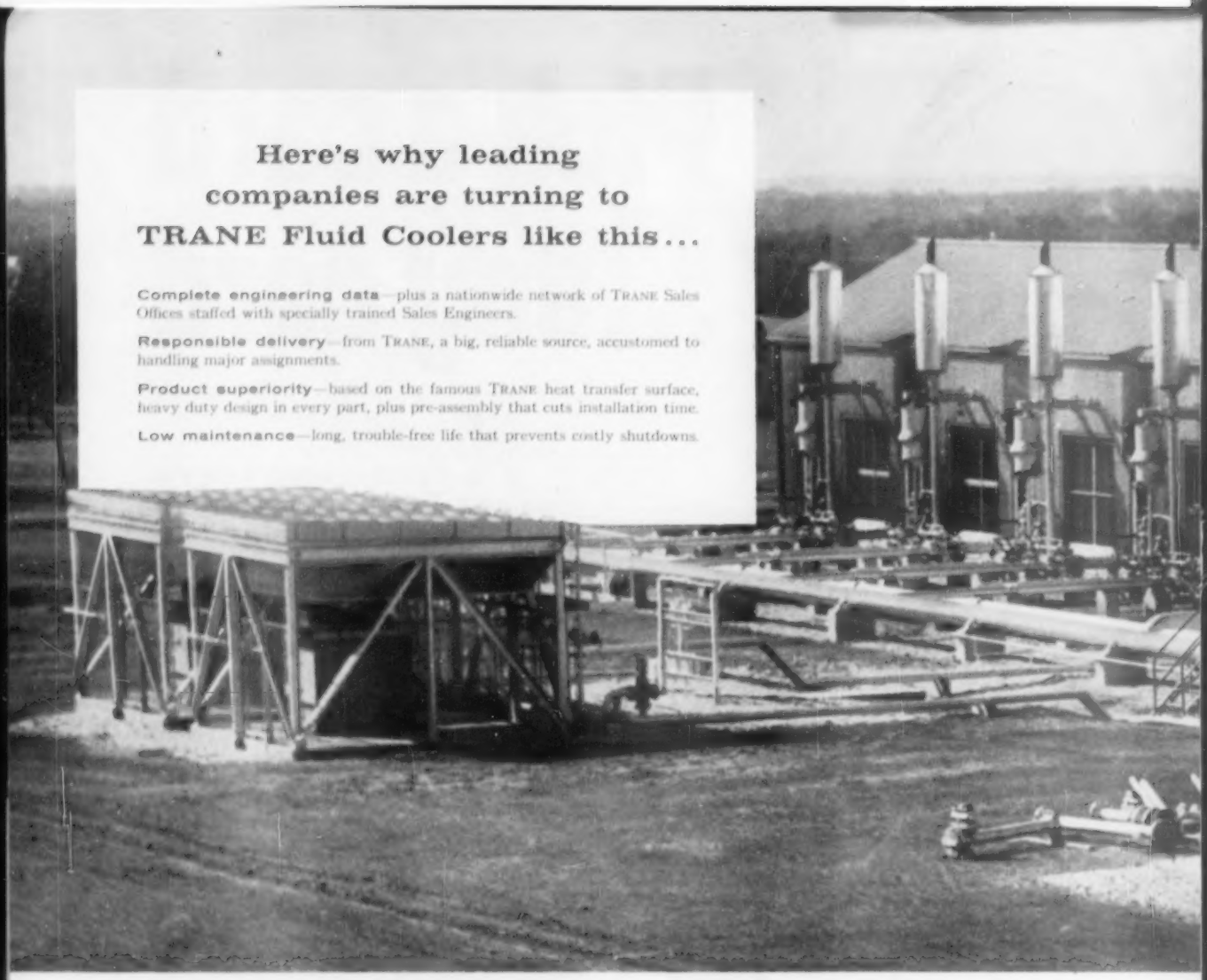
★ ★ ★

Write to National Tube Division, United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
(Tubing Specialties)
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS • UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS **NATIONAL SEAMLESS PIPE AND TUBES**

UNITED STATES STEEL



Here's why leading companies are turning to TRANE Fluid Coolers like this...

Complete engineering data—plus a nationwide network of TRANE Sales Offices staffed with specially trained Sales Engineers.

Responsible delivery—from TRANE, a big, reliable source, accustomed to handling major assignments.

Product superiority—based on the famous TRANE heat transfer surface, heavy duty design in every part, plus pre-assembly that cuts installation time.

Low maintenance—long, trouble-free life that prevents costly shutdowns.

Wilcox-Trend* uses

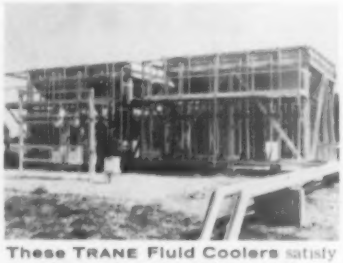
Texas Eastern Transmission uses TRANE units for gas

When Wilcox-Trend Gathering System, Inc. required two air cooled heat exchangers for their Thomaston, Texas station, they installed TRANE. These units were required to cool the jacket water from two 1,000 hp gas engines.

TRANE Fluid Coolers were selected for this important job—and TRANE Engineering Service provided complete detailed drawings and data.

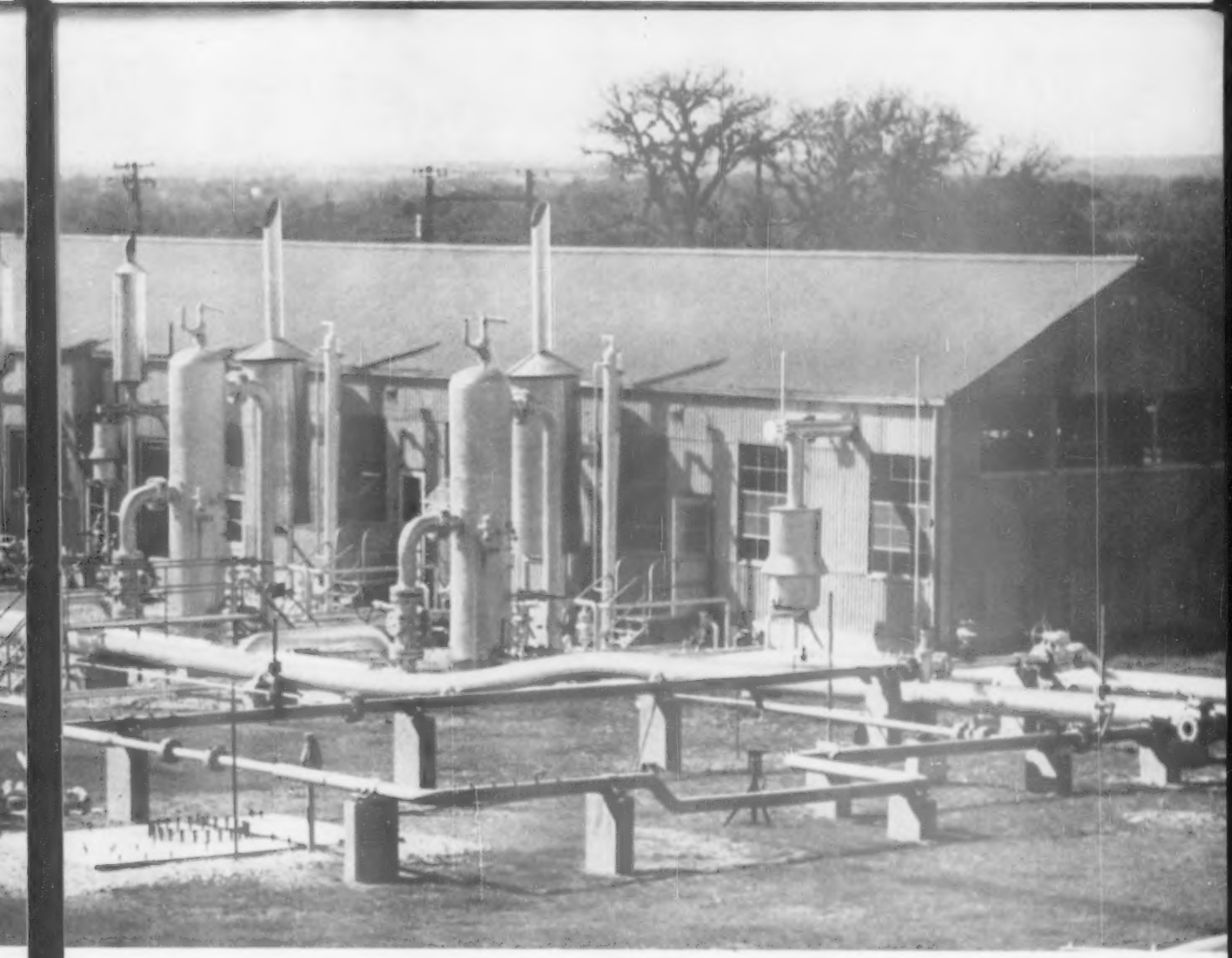
Making equipment for cooling is TRANE's business. When you turn to TRANE, you draw on thirty years of experience with fans and coils under all types of operating conditions. That's why more and more pipeline companies are using TRANE Fluid Coolers; they've discovered that in TRANE they have a reliable source for well-designed, well-built equipment for their cooling needs.

What's your fluid cooling problem? For complete information on how TRANE can help, call your nearby TRANE Sales Office—or write TRANE, La Crosse, Wis.



These TRANE Fluid Coolers satisfy capacity requirements with unusually low hp requirements. Designs are based upon capacity and performance data secured from tests in wind tunnels in the TRANE Engineering Laboratories.

**Wilcox-Trend Gathering System, Inc. A subsidiary of Texas Eastern Transmission Corp. Engineering Contractors: Brown & Root, Inc.*



Trane Fluid Coolers

Corporation subsidiary
engine compressor cooling

Fast, accurate installation of TRANE Fluid Coolers is assured. All framework parts are pre-drilled and match-marked at the factory to speed and simplify erection, cut labor costs, keep installations on schedule.

Air handling package—consisting of fan, motor and gearbox are shipped *factory-aligned* on a single metal base to eliminate vexing field alignment problems, save time and labor on the job.

For heating, cooling, ventilating...
For any air condition, turn to

TRANE

MANUFACTURING ENGINEERS

THE TRANE COMPANY, LA CROSSE, WIS., A DELAWARE CORP., SCRANTON, PA., A TRANE COMPANY OF CANADA, LTD., TORONTO
MFG. IN U.S. AND 13 FOREIGN COUNTRIES

exhaustive tests prove:

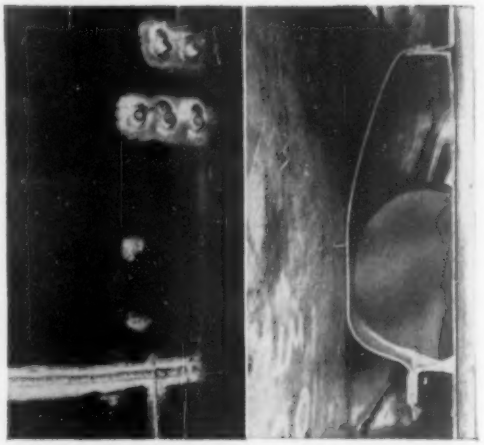
36 YEARS FROM TODAY

TUBESEALS* NOW IN FLOATING ROOF TANKS WILL OPERATE AS EFFICIENTLY AS THEY DO TODAY!

WE DOUBT this can be claimed for any other floating roof seal!

To determine the efficient life-expectancy of the Hammond Tubeseal in service, tests were made under the worst possible conditions to which a floating roof seal can be subjected. The Tubeseal was moved across very rough rivet heads, erection burrs and abrasive weld surfaces, for a total travel of 70,000 feet. This is equivalent to a normal wear of *more than 36 years in actual service.* Moreover, as the tests were run dry, there was the added disadvantage of the absence of lubricating effect normally created by wetted surfaces. Upon completion of these rigorous tests, the scuff band had only worn through the ribs and had barely penetrated through the material, leaving two-thirds of the stock intact; proof that the Tubeseal is unimpaired after traveling 70,000 feet.

The 36 year life-expectancy of a Hammond Tubeseal assumes no mechanical accident and is arrived at in the following manner: Each year a floating roof, in normal service, makes about 48 trips to and from top and bottom of tank. The roof of a 40 foot tank, therefore, will travel 1920 feet per year. Assuming 1920 feet of travel per year (based upon full depth of travel) and applying our accelerated wear test, the Tubeseal will be serviceable for at least 36 years 5½ months.



THE TUBESEAL TEST:

total travel	70,000 feet
travel over vertical weld	46,400 feet (on same line)
Horizontal welded seam crossed	21,200 times
Flat head rivets crossed	63,600 times

CONDITION OF TUBESEAL AFTER TEST: Scuff band had worn through ribs and had barely penetrated into the main material, leaving ⅔ of stock intact.

Tests were conducted dry with no aid of lubricant normally resulting from stored product.

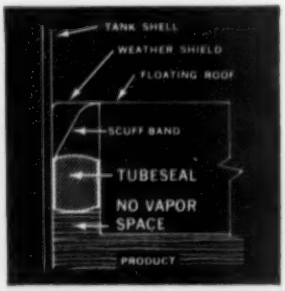
Photos show projections used for test. Included are 16" of ⅜" horizontal weld—24" of sharp, irregular vertical weld—2 erection burrs—3 ¾" flat head rivets and 2 ¾" cone head rivets.

THE HAMMOND TUBESEAL

is the most efficient and positive seal known.

it features:

no moving parts
no mechanical maintenance
climate proof
non-corrodible
can operate to bottom of tank or above the top
no vapor space below the seal
entire circumference has tight seal under pressure at all times
longer working life expectancy



NO ROOM FOR VAPORS
NO EVAPORATION
NO CORROSION

patented* ***Write for bulletin TS*

HAMMOND TUBESEAL — THE MOST EFFICIENT AND POSITIVE SEAL KNOWN

HAMMOND IRON WORKS

WARREN and BRISTOL, PA. • PROVO, UTAH • CASPER, WYO. • BIRMINGHAM, ALA.

Sales Offices:

BOSTON 10, MASS. • NEW YORK 20, N. Y. • CINCINNATI 2, OHIO • CHICAGO 3, ILL. • WARREN, PA. BRISTOL, PA. • ARLINGTON, VA. • GREENVILLE, S. C. • BIRMINGHAM, ALA. • SAGINAW, MICH. SAPULPA, OKLA. • PROVO, UTAH • CASPER, WYO. • LOS ANGELES 57, CALIF. • HAVANA • MEXICO CITY "TIPSA," BUENOS AIRES • CAIRO, EGYPT • PORT-AU-PRINCE, HAITI • LIMA, PERU

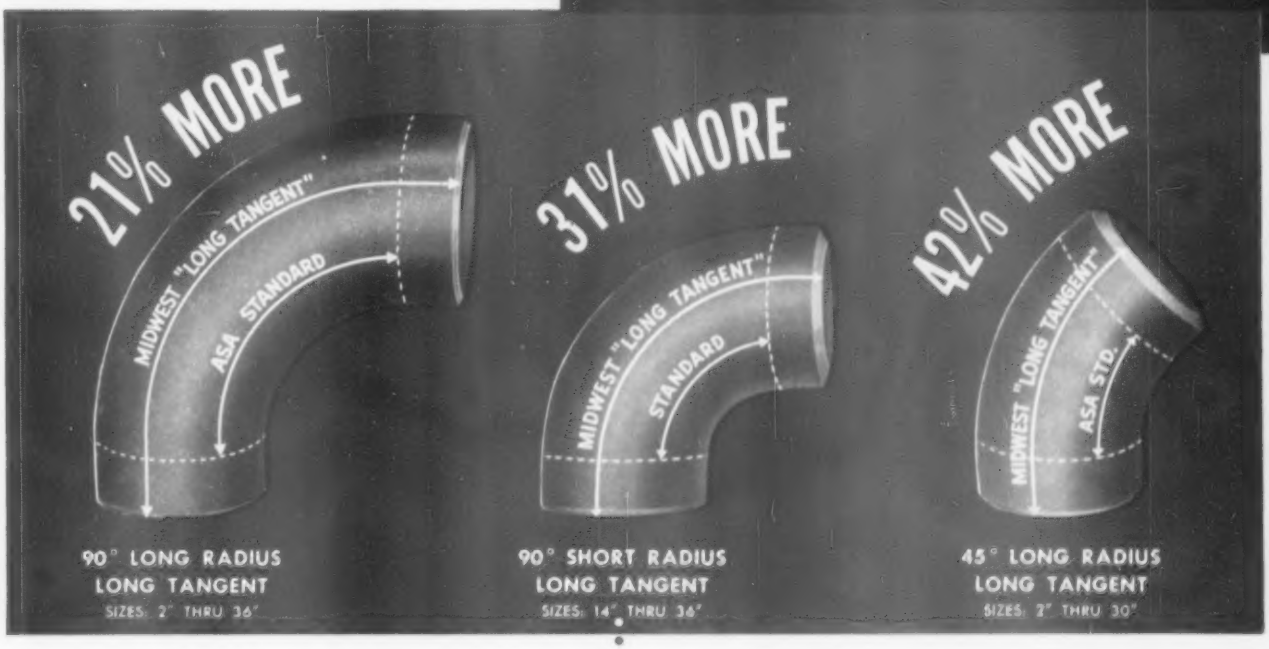
Licensees: CALIFORNIA, CANADA, ENGLAND, BELGIUM, GERMANY, ITALY, FRANCE, JAPAN

. . . you get

21% to 42% MORE ELBOW

for the same cost

When You Use MIDWEST "LONG TANGENT" ELBOWS



ADVANTAGES OF MIDWEST "LONG TANGENT" ELBOWS

- ★ They save pipe.
- ★ They often eliminate short nipples and their extra welds.
- ★ They save time and money in lining up and clamping pipe and fitting.
- ★ They make it easier to apply slip-on flanges.
- ★ They remove the circumferential weld from point of maximum stress and can be sleeved.
- ★ THEY COST NO MORE THAN OTHER ELBOWS.

The long tangents available *only* on Midwest Welding Elbows give you *more fitting for the same price* . . . Midwest "Long Tangent" Elbows cost no more than other elbows. This added length has numerous advantages for the user of welded piping . . . advantages that save money and improve piping. For all the facts, ask the nearest Midwest distributor or write us for Catalog 54.

MIDWEST PIPING COMPANY, INC.

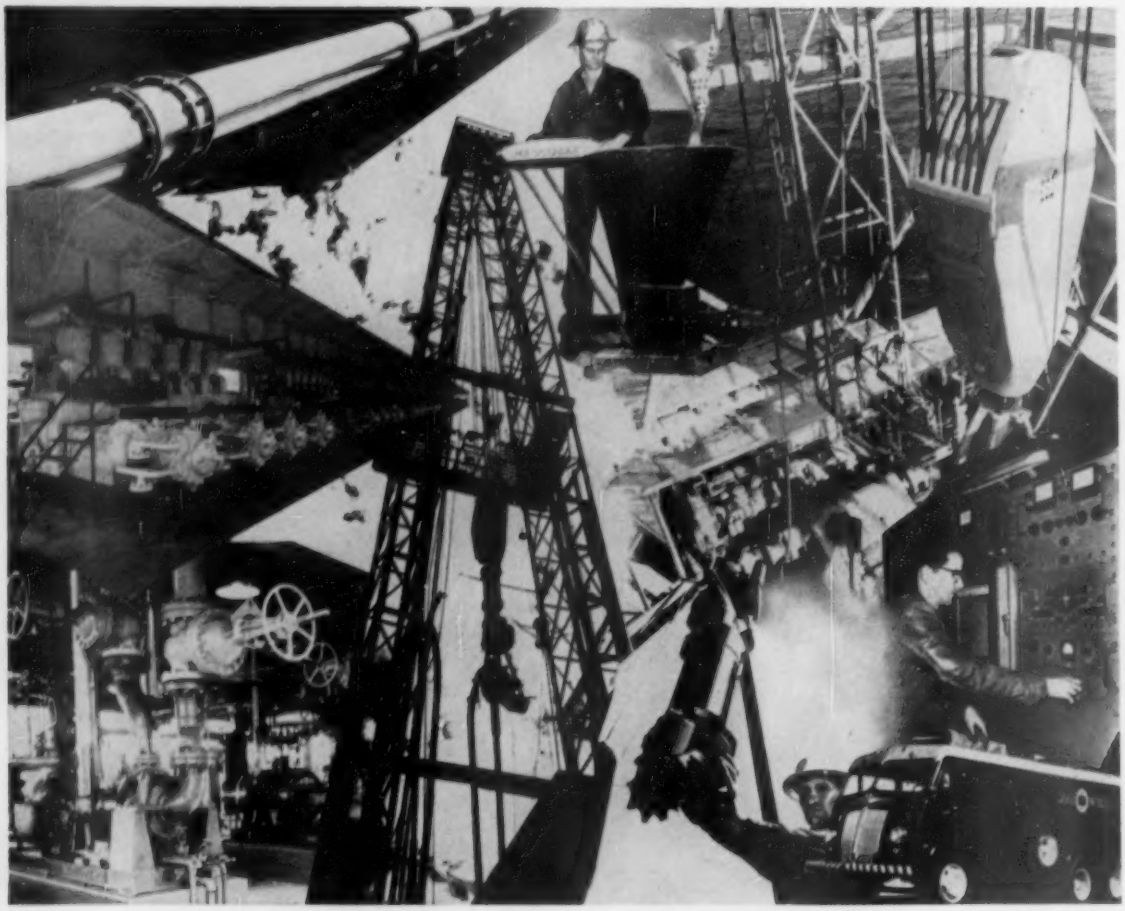
Main Office: 1450 South Second Street, St. Louis 4, Mo.
Plants: St. Louis, Clifton, N. J. and Los Angeles

Sales Offices:
New York 7—50 Church St. • Chicago 3—79 West Monroe St. Cleveland 14—616 St. Clair Ave. • Los Angeles 33—520 Anderson St. Houston 2—1213 Capitol Ave. • Tulsa 3—224 Wright Bldg. • Miami 34—2103 Le Jeune Rd. • Boston 27—426 First St. • San Francisco 11—420 Market St. • Oneida, N. Y.

STOCKING DISTRIBUTORS IN PRINCIPAL CITIES

WELDING FITTINGS IMPROVE PIPING DESIGN AND REDUCE COSTS

7324



Tomorrow's Progress Planned Today

ONE OF THE DRESSER INDUSTRIES

D

look for this symbol

...it identifies all Dresser Companies and their products

THE DRESSER INDUSTRIAL TEAM SERVES THE GROWING OIL

the Dresser Badges of Merit plus+

CLARK

CLARK BROS. CO., Olean, New York —Gas turbines, engines, and reciprocating, centrifugal and axial flow compressors—gas, steam, electric and diesel driven.

DRESSER IDECO

DRESSER-IDECO COMPANY, Columbus, Ohio—Radio and television broadcasting towers, steel buildings, aircraft hangars, electric power substations.

DRESSER MANUFACTURING DIVISION

DRESSER MANUFACTURING DIVISION, Bradford, Pa.—Pipe line couplings, pipe repair sleeves and clamps, weldments, forgings, welding fittings, flanges, rings.

IDECO®

IDECO, Dallas, Tex.—Hydrair® and Power Rigs; Full-View® Masts; substructures; single, dual and Drive-In Rambler Rigs; blocks, swivels, rotaries; mud pumps; petroleum equipment and supplies.

LANE WELLS

LANE-WELLS CO., Los Angeles, Calif., Houston, Tex., Oklahoma City, Okla.—Electric and Radioactivity Well Logging, Koneshot® perforating and bullet perforating, bridging plugs.

Magcobar®

MAGNET COVE BARIUM CORP., Houston, Tex.—Magcobar® and Magcogel® drilling muds and other specialized oil well drilling fluids and chemicals.

PACIFIC®

PACIFIC PUMPS, INC., Huntington Park, Calif.—Centrifugal pumps for refineries, power stations, pipelines, and chemical plants; plunger pumps for oilwells.

ROOTS-CONNERSVILLE®

ROOTS-CONNERSVILLE BLOWER DIVISION, Connersville, Ind.—Rotary positive blowers, gas pumps, centrifugal blowers, exhausters, vacuum pumps, and positive displacement meters.

Security

SECURITY ENGINEERING DIVISION, Dallas, Tex., Whittier, Calif.—Rock bits, reamer rock bits and hole openers; reamers, casing scrapers and Neo-Red rubber stabilizers.

SIE

SOUTHWESTERN INDUSTRIAL ELECTRONICS CO., Houston, Tex.—Seismograph systems and instruments—electronic, electro-mechanical. Computers—analog and digital; recording systems. Special transformers, reactors.

GUIBERSON

GUIBERSON CORPORATION, Dallas, Tex.—Oil tools: packers, anchors, workover equipment — drilling heads, blowout preventers, tubing blocks, hooks, swivels, kellys, savers, unions. Gas lift equipment. Molded rubber products.

*Trademark registered

put this DRESSER plus+ family to work for you!

You receive a bonus of extra value whenever you are served by any one of the Dresser companies. Each Dresser operating unit provides the research, engineering, manufacturing and service applications for its particular specialties. *All* work together to provide the combined experience and facilities of the world-wide Dresser industrial team. This inter-company teamwork offers a bonus in greater experience and technical knowledge – backed by the extensive Dresser facilities – in the customer's specific industry. This intangible but important factor is known throughout the world as the Dresser plus+ . . . the mark of superior equipment and services for the oil, gas, chemical, electronic, and general industry.

Dresser's world-wide engineering experience in many industries plays a major role in the creation of new developments and improved technological methods. No other single company provides the same broad range of equipment and services. The Dresser plus+ is a symbol for the superior quality of equipment and technical services which have become the standard of comparison in industries the world over!

DRESSER INDUSTRIES, INC.

EQUIPMENT AND TECHNICAL SERVICES

OIL • GAS
CHEMICAL
ELECTRONIC
INDUSTRIAL

POST OFFICE BOX 718 • REPUBLIC NATIONAL BANK BUILDING • DALLAS 21, TEXAS

OIL, GAS, CHEMICAL AND ELECTRONIC INDUSTRIES — EVERYWHERE

1513 — BALBOA DISCOVERS THE PACIFIC

EXPLORATION *has changed...*

ESPECIALLY OIL EXPLORATION!

SCIENCE has replaced guesswork in almost every kind of modern exploration technique. And the search for oil is no exception.

Western has maintained its foremost position in geophysical surveys with a long list of scientific "firsts" that are working for oil companies the world over . . . working to the most precise standards ever established to make the search for oil an efficient, effective operation.

Whatever your problem or requirement in land or water exploration, Western can help. *Your inquiry is invited.*

FOREIGN OPERATIONS

Western

GEOPHYSICAL COMPANY INTERNATIONAL

CANADIAN OPERATIONS

Western

GEOPHYSICAL COMPANY OF CANADA, LTD.

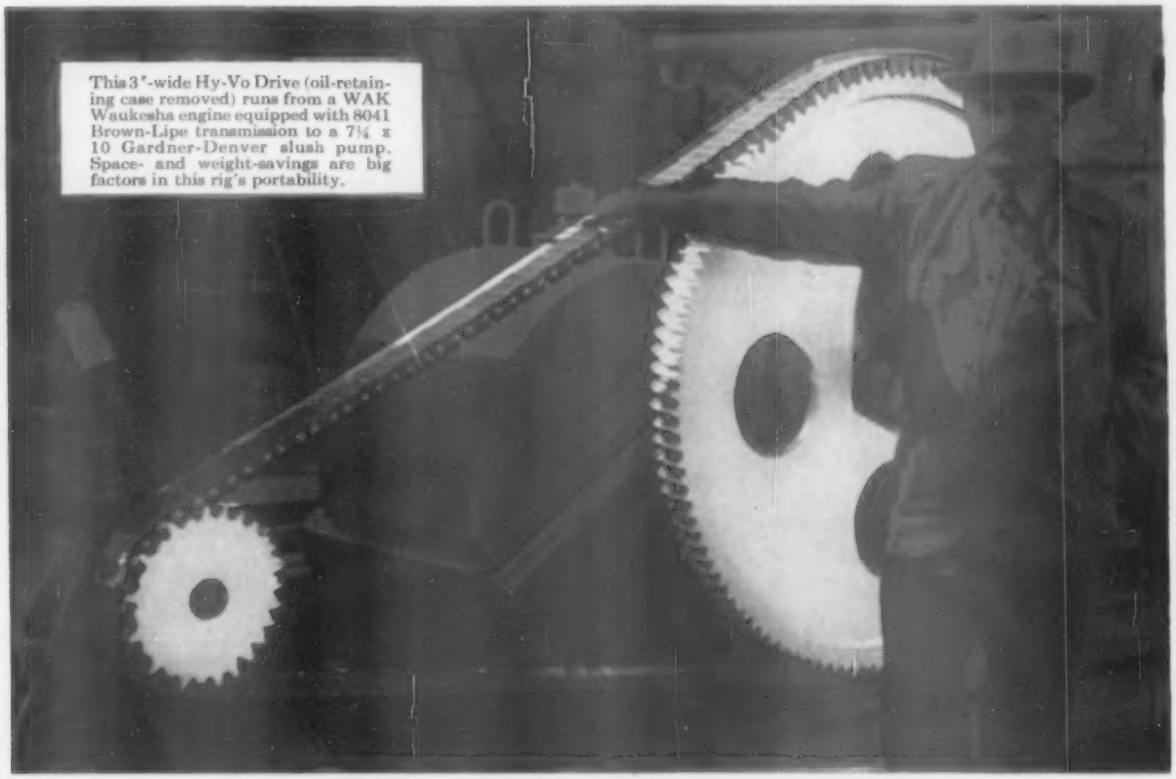
DOMESTIC OPERATIONS

Western

GEOPHYSICAL COMPANY OF AMERICA

Henry Salvatori, President

Pacific Mutual Bldg., Los Angeles 14, Calif.
Shreveport • Midland • Casper
Panama City • Calgary



This 3"-wide Hy-Vo Drive (oil-retaining case removed) runs from a WAK Waukesha engine equipped with 8041 Brown-Lipe transmission to a 7¼ x 10 Gardner-Denver slush pump. Space- and weight-savings are big factors in this rig's portability.

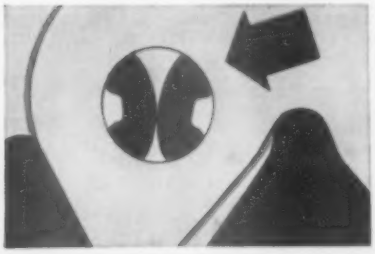
Morse Hy-Vo® Drives transmit high H. P. up to 50% faster in ½ the space!

Morse Hy-Vo Chain Drives transmit up to 5,000 hp, at speeds up to 8,250 fpm. These space-saving drives take only ½ the space that roller chain drives, or ¼ the space that V-belt drives, would need in similar applications!

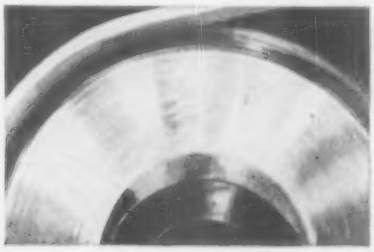
For complete information on the many economies Morse Hy-Vo offers rig manufacturers and operators, contact your local Morse representative; or write: *Morse Chain Company, Industrial Sales Division, Ithaca, New York.*

WHY HY-VO MEANS LESS DOWNTIME

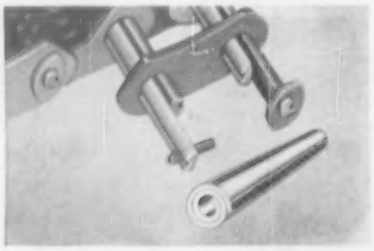
- Gives longer service life!
- Produces less vibration, noise and heat!
- Quickly installed without special tools!



New rocker-joint design prolongs chain life . . . eliminates joint slippage and wear. Keeps heat, noise and vibration to a minimum.



Smooth, belt-like flow of Hy-Vo at high speeds shows absence of destructive chordal action found in conventional chain drives.



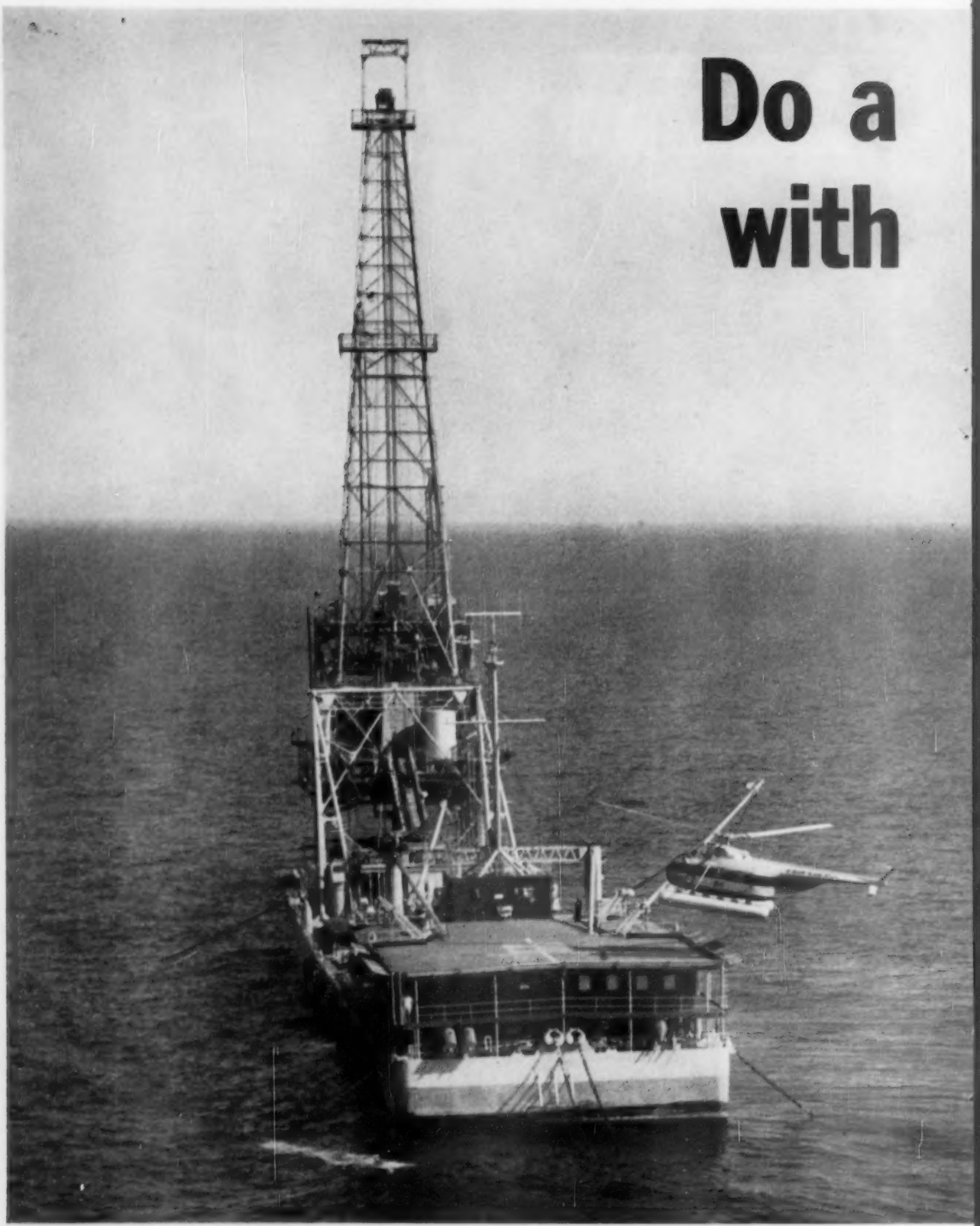
Rugged Spirol Pins—standard connectors for all Hy-Vo chains—can be furnished at any interval so that chain may be quickly taken apart.

MORSE

MORSE BW

POWER TRANSMISSION PRODUCTS

*Trademark



REGULAR, SCHEDULED FLIGHTS between rigs and shore bases simplify the offshore transportation problem. The 85 mph cruising speed of the Sikorsky S-55 makes the offshore trip quick and comfortable. Passengers step easily, safely from the helicopter cabin onto landing platforms on tenders or on rigs.

better job offshore Sikorsky Helicopters

Oil companies active offshore in the Gulf of Mexico area are discovering the clear-cut advantages of using big, dependable transport helicopters. Shuttling to and from rigs on routine trips or to meet rush needs, Sikorsky helicopters are today earning their way in both oil company and charter operation.

Fast and powerful Sikorsky helicopters in normal operations carry about 20,000 crewmen and specialists each month in the Gulf of Mexico area. Even the most distant rigs are reached easily, in a few minutes, and on short notice.

In today's service offshore, Sikorsky helicopters are again offering proof of their dependability and versatility . . . qualities which have been repeatedly shown in successful operation in jungles, at sea, in deserts, and in mountain areas.

The familiar Sikorsky S-55 and its new companion, the even larger S-58, are the acknowledged leaders in the transport helicopter field. They offer a solution for many of your offshore transportation problems.

SIKORSKY HELICOPTERS pay off in many ways. They cut investment in surface transportation, cut down generally high overhead costs by saving hour after hour of valuable time. At left, an S-55 lands aboard a deep-water rig on a platform built atop the crew's living quarters.

EVEN LARGER SIKORSKY S-58s, proved by the military and now available commercially, are being ordered with flotation gear for offshore service. Here, Okanagan Helicopters Ltd. accepts delivery of an S-58 scheduled for high-priority cargo work in the remote Canadian North. An S-58 can carry 12 passengers 150 miles offshore and return without refueling. It cruises at better than 100 mph.

For more information on Sikorsky helicopters, telephone or write B. L. Whelan, general manager, Sikorsky Aircraft.

SIKORSKY AIRCRAFT BRIDGEPORT, CONNECTICUT
One of the Divisions of United Aircraft Corporation

LUFKIN'S new concept in pumping unit design?

NO—We have mounted the small unit piggie-back style on top of this goliath of beam type pumping units to emphasize the striking contrast in size between the largest and smallest LUFKIN assemblies.

LUFKIN UNITS COVER THE ENTIRE RANGE OF SIZES REQUIRED BY THE OIL INDUSTRY.

Whether the Peak Torque capacity is 10,000 inch pounds or almost one million inch pounds, the same rugged construction, modern design, and careful workmanship go into the manufacture of LUFKIN UNITS.

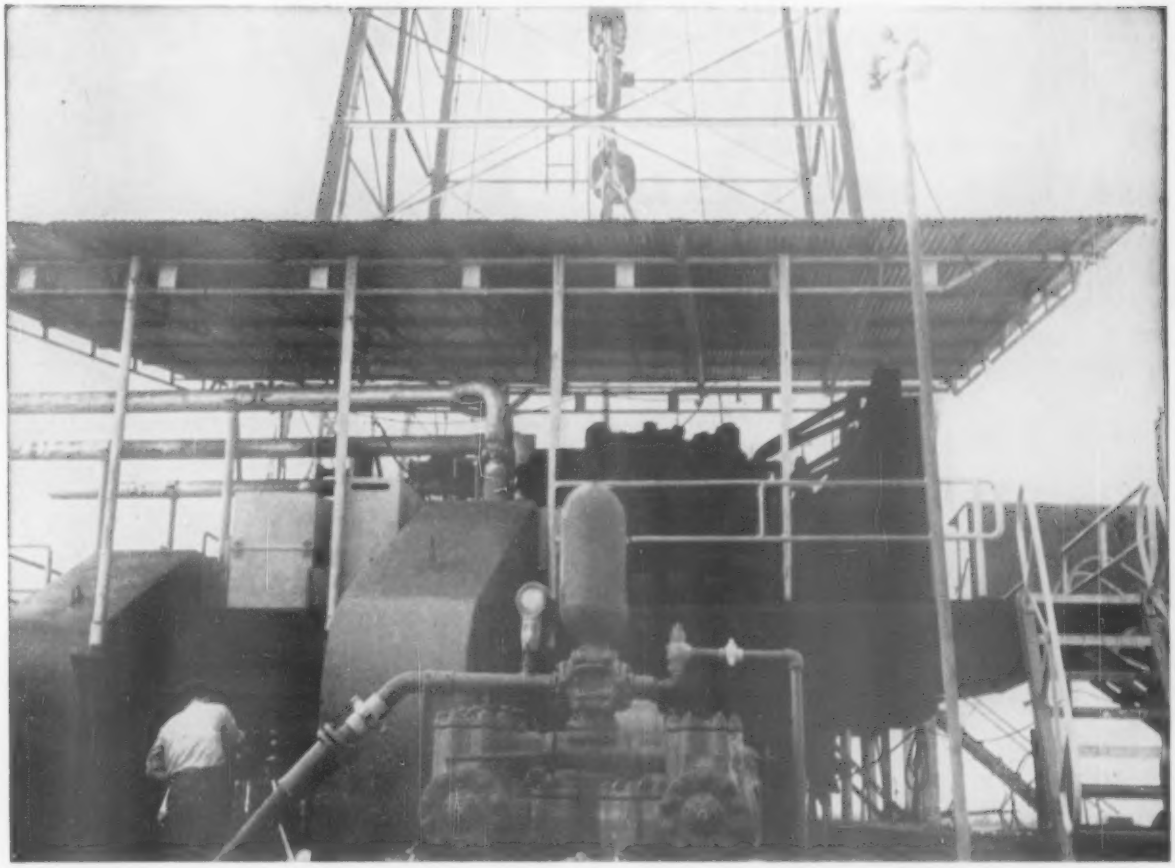
SHOWN HERE IS THE MASSIVE NEW LUFKIN A-912DA-192-42 AIR BALANCED UNIT WITH 912,000 INCH POUNDS PEAK TORQUE, 192 INCH STROKE, AND 42,000 POUNDS BEAM RATING, AND THE TINY B-10D-20-4 WITH 10,000 INCH POUNDS PEAK TORQUE, 20 INCH STROKE AND 4,000 POUNDS BEAM RATING.

Lufkin **FOUNDRY & MACHINE COMPANY**

LUFKIN, TEXAS

Branch Sales and Service: Houston • Dallas • New York • Tulsa • Los Angeles • Seminole • Oklahoma City • Corpus Christi • Odessa Kilgore • Wichita Falls • Casper, Wyoming • Great Bend, Kansas • Effingham, Illinois • Duncan, Oklahoma Brookhaven, Mississippi • El Dorado, Arkansas

Lufkin equipment in Canada is handled by THE LUFKIN MACHINE CO. LTD. 9950 65th Avenue, Edmonton, Alberta, Canada 3913 18th Avenue, Regina, Saskatchewan, Canada



Deephole Drilling . . . In a Hurry !

. . . the acceleration, lugging power, and dependability you get from Le Roi L3460 and L4000 engines mean faster round trips and lower drilling costs.

WHEN you have to go deep you need plenty of horsepower. And the place to get it is from Le Roi's L3460 with 600 max. hp. or its big brother, the L4000 with 655 max. hp.

You get much more, too. You get compactness. These V-12 overhead-valve engines are only 164 in. long. That makes them ideal for drill-rig installation, because they pack a lot of power in a small space — give you more horsepower per dollar.

But that's not all you get from these high-output engines. They represent the first, truly new design concept in 15 years. They have improved fuel economy; integral crankcase and cylinder construction for greater rigidity; longer bearing life; hydraulic valve lifters; better manifolding; husky crankshaft with integrally forged counterweights for unbelievably smooth operation — modern features that mean lightning response to load demands, outstanding performance and dependability.

Like all Le Roi engines, they're built to stand oilfield handling; they're easy to service; they have a wide speed range up to 1350 rpm; and they operate on natural gas, butane, or gasoline.

Ask your supply house or Le Roi distributor to show you an L3460 or L4000 at work. See for yourself why they can help you make hole faster. Literature is also available — just write us for it.

P-170

LE ROI *Division of Westinghouse Air Brake Co.*

Milwaukee 1, Wisconsin

PORTABLE AIR COMPRESSORS

TRACTAIR

STATIONARY AIR COMPRESSORS

AIR TOOLS

ENGINES

See them Now!

Industry's MOST WANTED line of GENERAL PURPOSE VALVES

FOR PETROLEUM REFINERIES
CHEMICAL PLANTS • POWER PLANTS

Write for Supplement No. 1 to Catalog F-9

Address Dept. 24A-FO

MOST WANTED — that's right — because the G P line includes gate, globe, and angle type valves having seats faced with **HAYNES STELLITE*** alloy or other hard facing alloys for greater seat-wear resistance . . . at no extra cost!

Hard faced seats, in combination with precision finished, selectively hardened discs and wedges give these valves amazing resistance to erosion, corrosion and galling. That's why they are setting new standards of performance in steam, water, oil, or gas services at the recommended pressures and temperatures.

Get longer, drop-tight, service life with minimum maintenance by specifying Vogt G P Valves. Available in a complete range of sizes from ¼" to 2" and rated 800 pounds at 850°F. and 2000 pounds at 100°F.

HENRY VOGT MACHINE CO.
P. O. Box 1918—Louisville 1, Ky.

SALES OFFICES: New York, Chicago, Cleveland, Dallas, Philadelphia, St. Louis, Charleston, W. Va., Cincinnati, San Francisco

Vogt

GENERAL GP PURPOSE

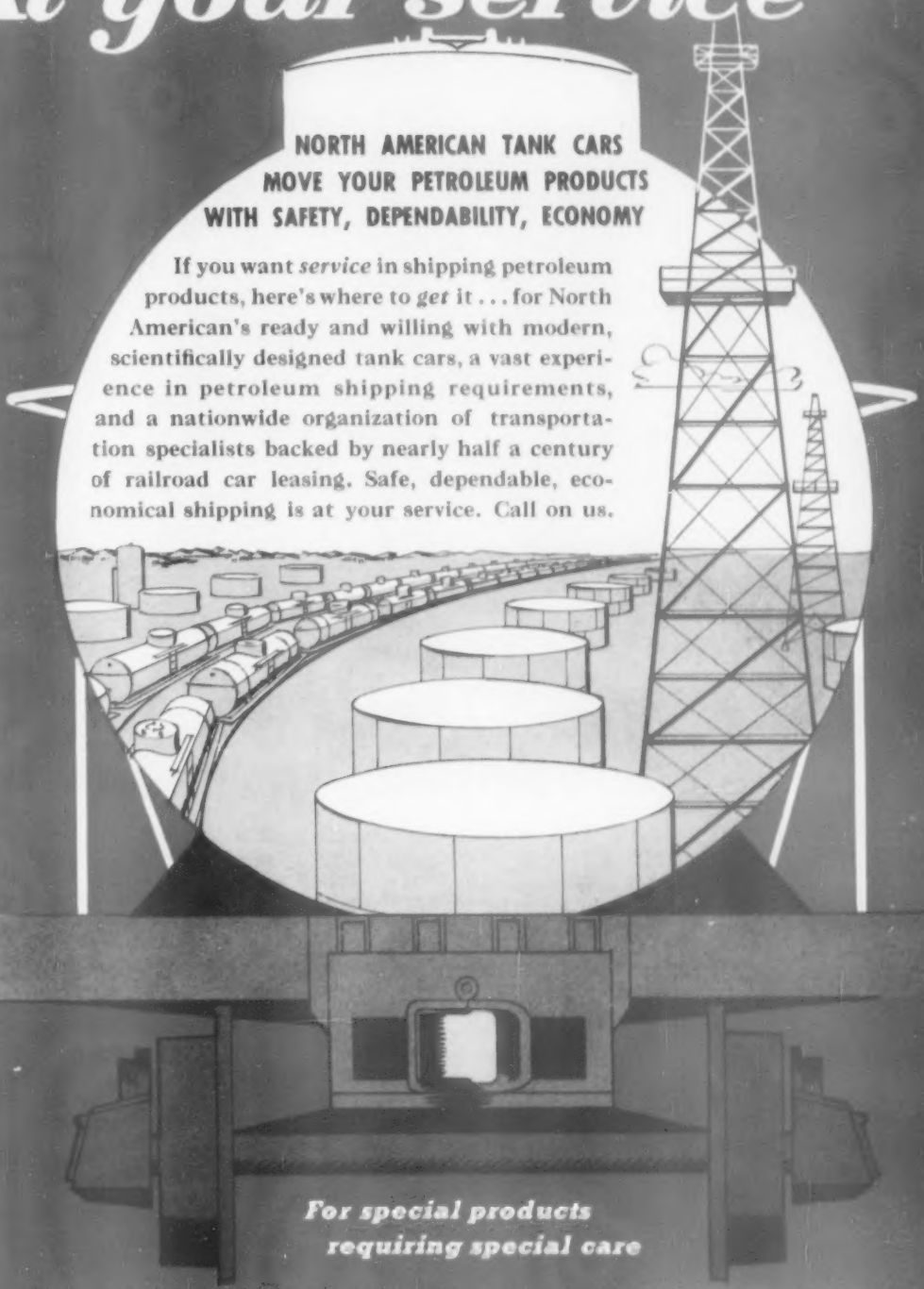
Vogt FOR BETTER VALVES

DROP FORGED STEEL

VALVES

*Trade-Mark of Union Carbide and Carbon Corporation

At your service



NORTH AMERICAN TANK CARS MOVE YOUR PETROLEUM PRODUCTS WITH SAFETY, DEPENDABILITY, ECONOMY

If you want *service* in shipping petroleum products, here's where to *get* it . . . for North American's ready and willing with modern, scientifically designed tank cars, a vast experience in petroleum shipping requirements, and a nationwide organization of transportation specialists backed by nearly half a century of railroad car leasing. Safe, dependable, economical shipping is at your service. Call on us.

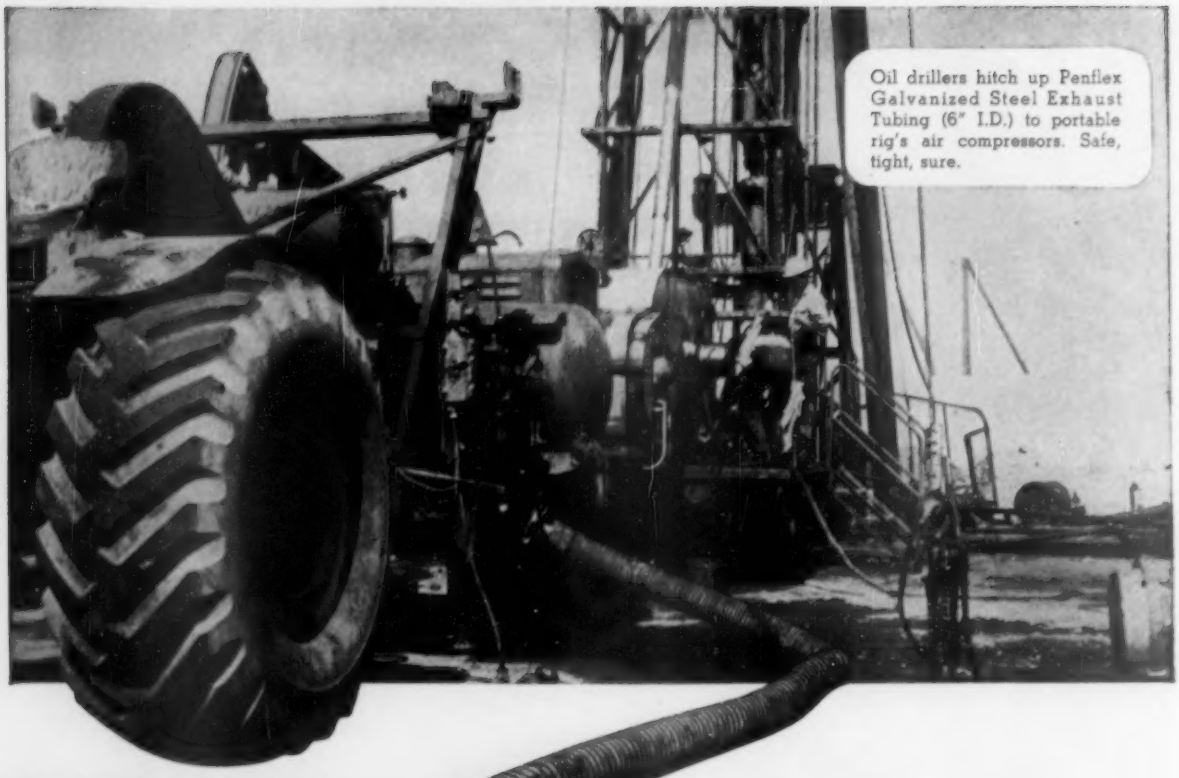
For special products requiring special care

NORTH AMERICAN CAR CORPORATION

NORTH WESTERN REFRIGERATOR LINE COMPANY
MATHERS HUMANE STOCK TRANSPORTATION COMPANY

A NATIONWIDE ORGANIZATION WITH BRANCH OFFICES IN IMPORTANT MARKET CENTERS
231 South La Salle Street, Chicago 4, Illinois

Dallas • Fond du Lac • St. Paul • St. Louis • Tulsa • San Francisco • New York



Oil drillers hitch up Penflex Galvanized Steel Exhaust Tubing (6" I.D.) to portable rig's air compressors. Safe, tight, sure.

PENFLEX holds air, gas, volatiles, granulars tight

Huge oil storage tank "walks" with the weather thanks to Penflex four-wall Interlocked Tubing of Galvanized Steel (12" I.D.), and tight-packed flanges.

Exhaust gases sneak through ordinary flexible hose—but not through Penflex. Its four-wall interlocking design, with or without packing, holds tightly whatever you convey . . . gases, liquids or granulars.

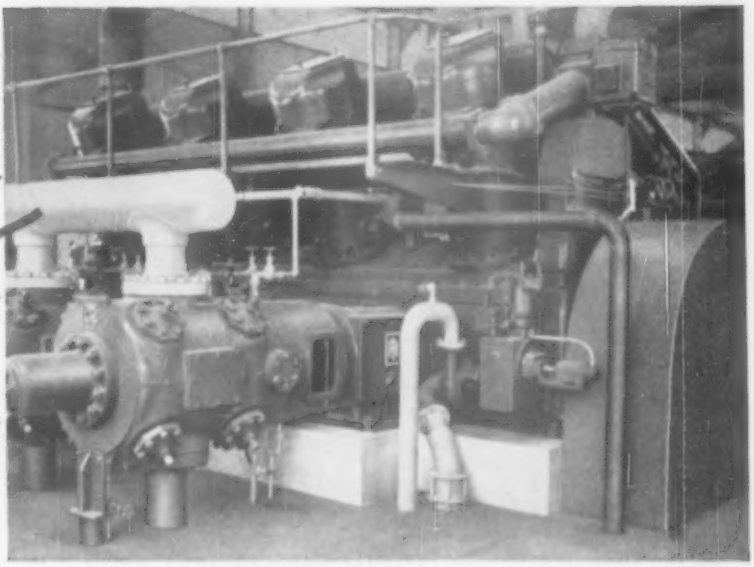
Penflex has hundreds of applications in the oil and gas fields and a complete tubing assembly specific to each. Drilling, for example, illustrated above. Pipeline laying . . . where Penflex pipes hot tar and asphalt from heater to painting and wrapping machine. Processing . . . where Penflex seals pipe joint assemblies on petroleum still burners. Storage . . . where Penflex provides flexible but leakproof connections for huge tanks. The list of applications is lengthening daily.

Write for "Flexineering", your guide in buying and using Penflex Interlocking and Corrugated Tubing, and Penflexweld, the High-pressure Tubing for service where leaks are fatal. No charge or obligation.

Pennsylvania Flexible Metallic Tubing Company, Inc., 7213 Powers Lane, Phila. 42, Pa.
Branch Sales Offices: **Boston • New York • Chicago • Houston • Cleveland • Los Angeles and Distributors in Principal Cities**

COMBINES FLEXIBILITY WITH DURABILITY

A NEW HIGH FOR I-R GAS-ENGINE COMPRESSORS



One of seven KVG Gas-Engine Compressors at Big Piney Station of Pacific Northwest Pipeline.

Seven KVG Units at 7,325 ft. altitude deliver gas from **BIG PINEY FIELD** to Pacific Northwest Pipeline

The Big Piney Station of the new Pacific Northwest Pipeline system is of special interest for two reasons.

Located at an elevation of 7,325 ft above sea level, it is the highest pipeline compressor station in the country—operating in temperatures ranging down to 40° below zero.

It has made possible the commercial utilization of Big Piney Field, which has been shut in for the past 18 years by lack of transportation facilities.

Hence it was quite appropriate that opening ceremonies for the Pacific Northwest Pipeline were held at Big Piney—where seven Ingersoll-Rand KVG Gas-Engine Compressors boost field gas to pipeline pressures. Two 880-hp units and two 660-hp units operate with intake pressures of 100-350 psi and discharge pressures of 400 to 550 psi. Three more 660-hp units have intake from 400 to 550 psi and discharge pressures of 650 to 850 psi.

Because of the extremely high altitude, the gas engines were supplied in bigger-than-normal sizes. Combined rated horsepower of the seven Big Piney units would be 5,060 hp at normal 1,000 ft altitude—for an actual load of about 3,885 hp under average conditions. The station is completely "winterized" for dependable operation at sub-zero temperatures.

Ingersoll-Rand Gas-engine Compressors now serving the various stations of the Pacific Northwest Pipeline include the following types and sizes:

5VG compressors, 330 hp
KVG compressors, 660 and 880 hp
Turbocharged KVS units, 1000 and 2000 hp
PKVG Gas Engine Power Units, 1100 hp

For maximum stability, flexibility and long-range economy under all pipeline conditions, it pays to specify Ingersoll-Rand four-cycle gas-engine compressors. Your I-R representative will gladly give you complete information on the units best suited to your needs.

Ingersoll-Rand
11 Broadway, New York 4, N. Y.

6-466

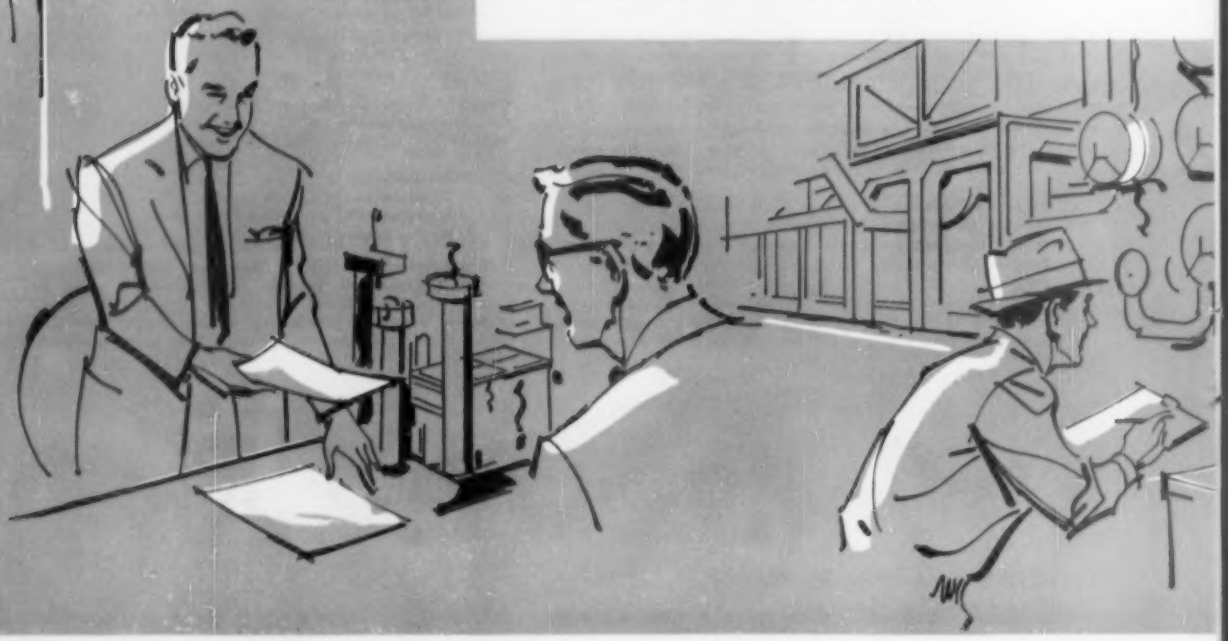
COMPRESSORS • AIR TOOLS • ROCK DRILLS • TURBO-BLOWERS • CONDENSERS • CENTRIFUGAL PUMPS • GAS & DIESEL ENGINES

some
very good
people

are helping make your

Whether it is washing machines, breakfast foods, or petroleum products, the marketing of any merchandise is dependent on good salesmanship.

But the more salable a product is, the more resultful is the application of good salesmanship to it. Behind the scenes in the petroleum industry some very good people are helping make petroleum products more salable, so that good salesmanship, at the wholesale and retail level, can pay off to the fullest degree. May we tell you about some of these people?



petroleum products more salable!

For instance, at Universal there are the scores of petroleum research scientists working with the most modern equipment. These men are constantly seeking ways to make better products from every barrel of crude oil processed by the petroleum refining industry.

Then there are the groups of process engineers constantly studying ways and means of more economically producing motor fuels required by today's automotive engines and the many other products which the consuming public requires from the petroleum industry.

Technicians and engineers are always at work in the field, too, constantly checking the efficiency of the refining processes and the quality of finished products—helping the refiner adjust his process operations so that he can, at all times, adequately supply the constantly shifting demand.

We are citing these three types of men of science because we know them intimately. They have been functioning here at Universal for over forty years in helping refiners the world over. Similar good people are doing the same type of helpful work in the research and technological departments of individual refiners, too. So, however you sell in this industry, wholesale or retail, you can count on the help of some very good people to make the petroleum products you sell more salable.

UOP has prepared an interesting booklet on "How Men of Science Help You Sell". We'll be glad to send you a copy on request.

UOP

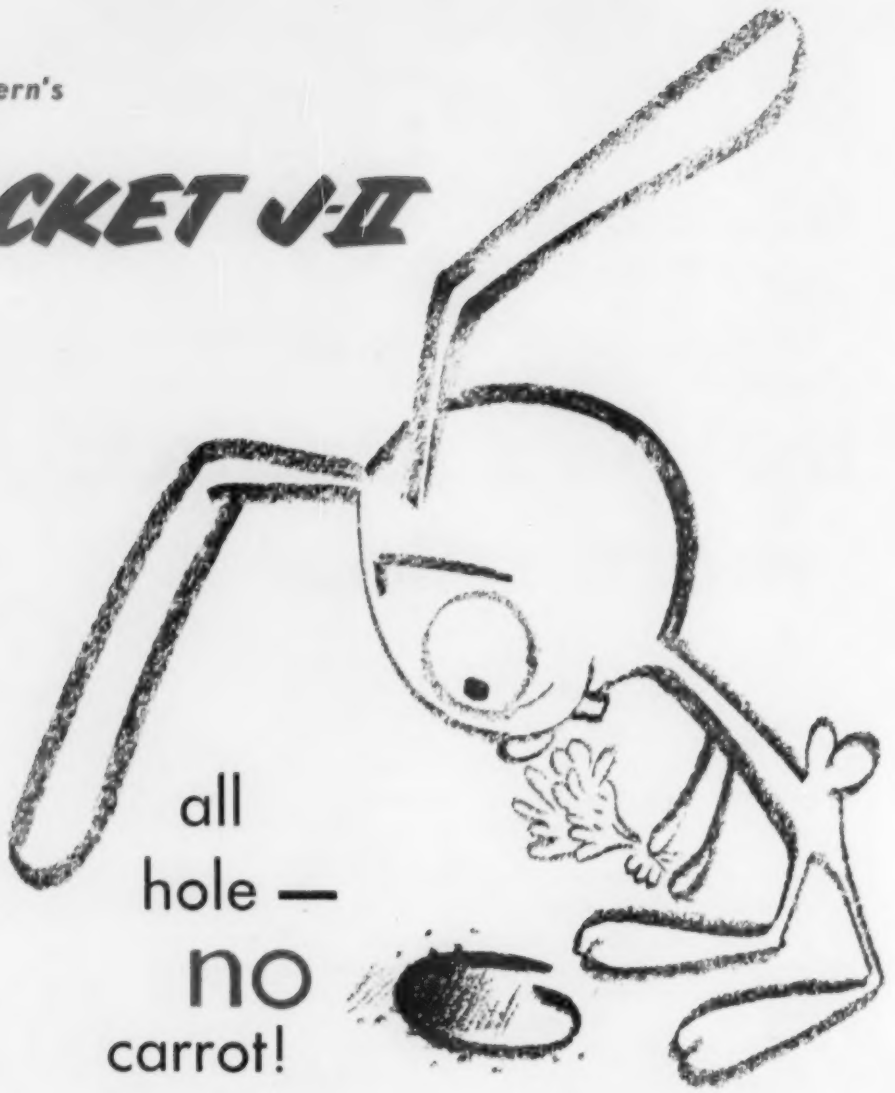
UNIVERSAL OIL PRODUCTS COMPANY

30 Algonquin Road, Des Plaines, Illinois, U. S. A.

Forty Years Of Leadership In Petroleum Refining Technology

Western's

ROCKET J-II



The newest concept in perforating—that's Western's Rocket J-II.

Western has eliminated the carrot that blocks perforations in conventional jet perforating—the slug that robs the hole of effectiveness in fluid flow.

Developed by Western after more than a year of research, the Rocket J-II outperforms all other perforating tools. The Rocket J-II gives *effective* penetration—obstruction free—plus a larger entry hole.

Verified in standard tests by independent observers, and proven in the field, the Rocket J-II averages a 5/8-inch diameter entry hole and 3.7 inches penetration in mild steel bars, the standard test target.

Perforate your well with the leader in perforating—the Rocket J-II—superior perforating at standard jet prices. Call the nearest Western engineer today. And for the other Western engineered well services—logging, fracturing and acidizing, next time, GO WESTERN!

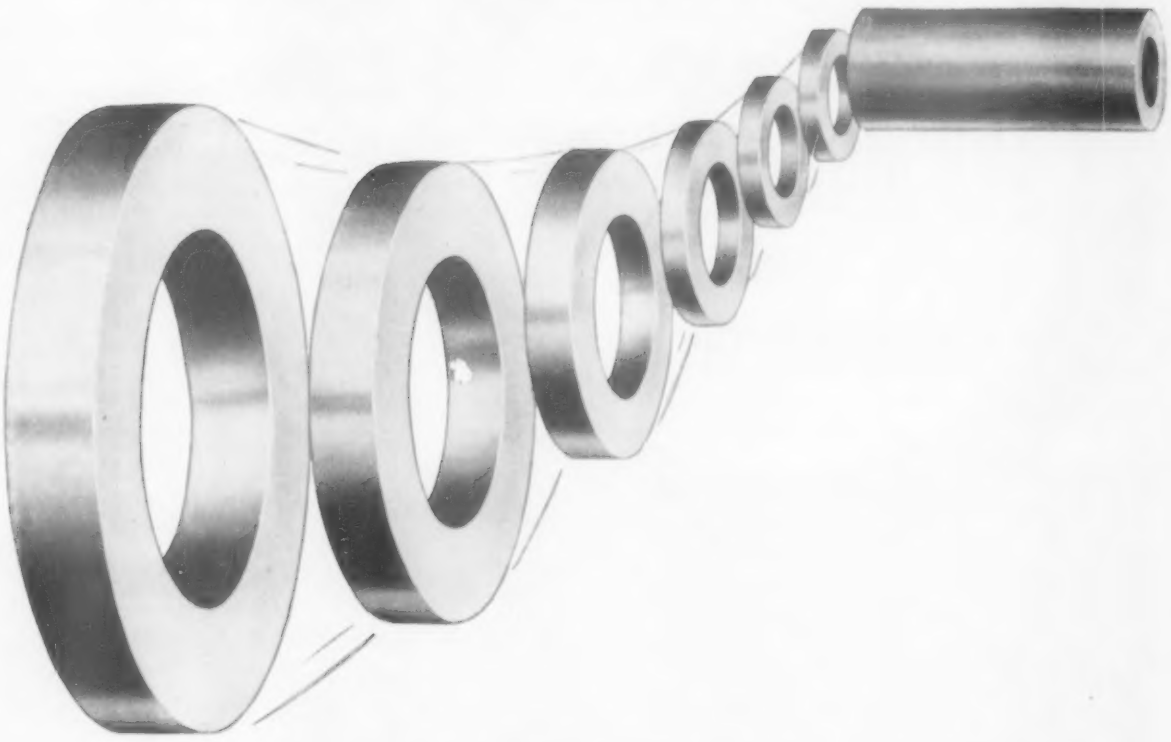
WESTERN Engineered

THE WESTERN COMPANY

general offices: Midland, Texas

Texas: Odessa, Seagraves, Andrews, Snyder, Lubbock, Borger, Ranking • Okla.: Lindsay, Healdton, Oklahoma City • New Mexico: Hobbs • Kansas: Ulysses, Liberal

How to add machining capacity without adding machines



. . . and save money on your steel!

ARE you making hollow parts, or boring out solid bar stock? Timken® seamless steel tubing can eliminate that unnecessary and costly boring operation—because Timken seamless steel tubing comes with *the hole already there.*

By cutting out this needless operation, you free screw machine stations for other jobs. You get increased machining capacity without adding machines. More than that, you pay only for the steel you use—without wasting solid bar stock centers. And of course you speed up your hollow part operation by starting with Timken seamless steel tubing; *finish* boring can become your first production step.

Timken seamless steel tubing is made by a piercing process which is basically a forging operation. So you get fine forged quality: uniform spiral grain flow for greater strength, and refined grain structure. This quality is maintained from heat to heat, tube to tube and order to order. The Timken seamless steel tubing recommended by our engineers as *your* most economical tube size will be guaranteed to clean up to your finished dimensions.

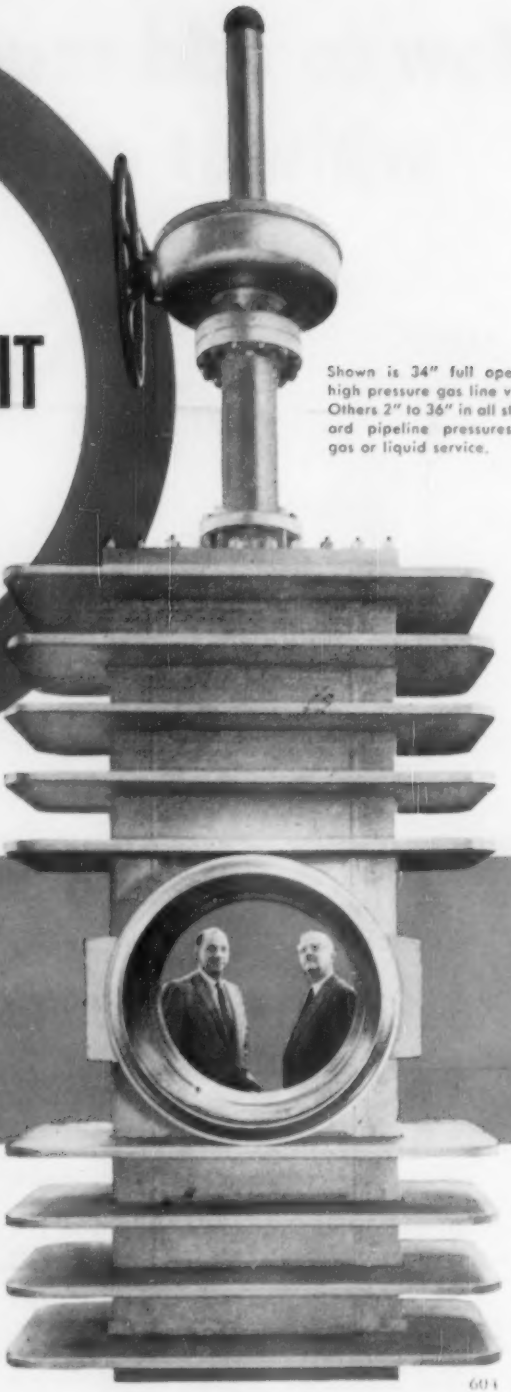
The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

TIMKEN *Fine Alloy* STEEL

TRADE-MARK REG. U.S. PAT. OFF.

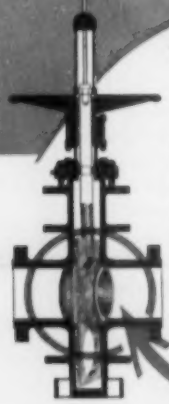
SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING

the gate valve with THROUGH CONDUIT always in line with the line



Shown is 34" full opening high pressure gas line valve. Others 2" to 36" in all standard pipeline pressures for gas or liquid service.

- Solid one-piece parallel-faced gate always moves freely to the same precise full open or closed position
- No wedging to cause wear and consequent misalignment
- Nothing to impede free movement of line cleaning devices



THE WHOLE VALVE IS RIGHT HERE

When valve is full open or closed, bubble-tight seals on both sides of the gate completely isolate line pressure in the conduit. The body, serving merely as framework for operating mechanism and to prevent loss of product while gate is in motion, may be drained or vented to atmosphere when gate is open or closed. Integrity of seals can be checked any time by a tell-tale valve on the body.

604

GROVE SEAL-"O"-RING Gate Valves

GROVE VALVE and REGULATOR COMPANY • 65th & Hollis Sts., Oakland 8, California
HOUSTON 4 — 1901 Calumet St. • • • • • • • • LOS ANGELES 6 — 1930 W. Olympic Blvd.

ODESSA, TEXAS • TULSA, OKLAHOMA • DENVER, COLORADO • In Western Canada: GROVE VALVE LIMITED

GROVE SIMPLICITY ACCURACY SAFETY

DU PONT

PETROLEUM CHEMICALS DIVISION NEWS

DU PONT

November ★ One of a Series of Bulletins for the Petroleum Industry ★ 1956

Du Pont uses sports car to study fuel-injection related to product development

Although sports cars are designed for road racing or as a highway hobby, the Du Pont Petroleum Laboratory is now using one for an entirely different purpose.

With an eye to future automotive fuel requirements, the laboratory is now fitting out a new Mercedes-Benz, 300 SL, with special instrumentation. The objective is to investigate the additive needs of fuels for fuel-injection engines and to test promising candidates under actual road conditions. The Mercedes-Benz was picked for this work because it is the only car with a fuel-injection engine that is commercially available in this country.

Mercaptide problems solved with DMD

If you are not now using Du Pont Metal Deactivator in your heating and diesel fuels, we believe you will be interested in the success of other refiners who have used it.

Several years ago, for example, a major oil company was having copper mercaptide problems. They encountered the trouble in both straight-run diesel fuel and No. 2 fuel oil composed of 95% straight-run and 5% Houdry cat-cracked.

To solve the problem, 2 pounds of DMD per 1,000 barrels were added to both fuels. This proved highly successful for several seasons. Then the use of DMD was discontinued. The trouble recurred. So DMD was again added, and this company's mercaptide problem was again under control.

Another major company encountered gel-clogging complaints in the Spring of 1955. The trouble involved a No. 2 fuel oil composed of fluid cat-cracked and straight-run. The cracked component varied in composition from 75% to 90%.

During the next heating season, the company added 2 pounds of DMD (in combination with Du Pont Fuel Oil Additive No. 2) per 1,000 barrels. There were no complaints of mercaptide formation reported the following season.

These are only two of the many success stories reported by refiners using DMD to combat mercaptide problems and complaints. And many refiners have found that since the cost of adding effective amounts of DMD is so low, it pays to use it as an "insurance" against copper contamination in a wide variety of products.

Greases containing Du Pont Estersil GT prove highly successful in many types of service

It was about two years ago that Du Pont estersil grease thickener was first introduced.

Since then, millions of pounds of grease made with this unique thickening agent have been used in a wide variety of industrial and automotive applications. And the success obtained with these greases has been truly outstanding.

Photo courtesy Joy Mfg. Co.

CONTINUOUS MINER—completely lubricated with estersil grease

One coal mining company, for example, reports that they eliminated the need for using three different mining equipment lubricants by standardizing on semi-fluid estersil-based grease in their continuous miners, loading machines and shuttle cars.

In the gear cases of the continuous miners, this company, before using an estersil grease, had a lubricant consumption of two to three *gallons* per shift. When they changed to an estersil grease, they found that the average consumption immediately dropped 75% to two to three *quarts* per shift. On loaders they actually stopped keeping records because the consumption was so small.

Longer gear life

When rebuilding machines, this same company had almost always replaced bearings and gears. But since switching to the estersil grease, they found that the gears could be used over and over again without significant wear. This was probably due – at least partially–to the fact that the estersil grease effectively sealed out moisture, dirt, coal dust and other abrasive foreign matter.

Maintenance costs down

Another user in the coal industry re-

DU PONT

PETROLEUM CHEMICALS DIVISION
NEWS

DU PONT

CONTINUED *Estersil GT*

ports that the use of an estersil-based grease has caused his maintenance costs on a group of cutting machines to drop from .185 cents per ton to less than .09 cents per ton—a 50% saving.

Many users report that equipment runs much cooler and quieter with estersil-based greases.

In addition to heavy-duty industrial applications, estersil greases have been used in several automotive applications. In passenger cars, test engineers

THIS DEMONSTRATION dramatizes the unusual water resistance of estersil greases. They can be immersed in boiling water for long periods without breakdown.

report, these greases greatly prolong the smoother, easy-riding effect of a fresh lube job.

In heavy-duty earth-moving equipment, estersil greases often provide significant savings in downtime and maintenance costs. In some instances, crane and shovel operators reported an almost immediate cessation of leakage from hoist drum bearings on to the brake bands after switching to estersil grease.

Exceptional water resistance

Du Pont Estersil GT is an entirely *new type* of grease thickener. It is a pelletized form of finely divided amorphous silica. One of its unique features is that each minute particle is enveloped in a chemical "raincoat" which gives estersil-based greases positive, built-in water resistance and eliminates the danger of washout.

Continued middle next column

ASSISTANT TO THE SALES MANAGER—ADDITIVES

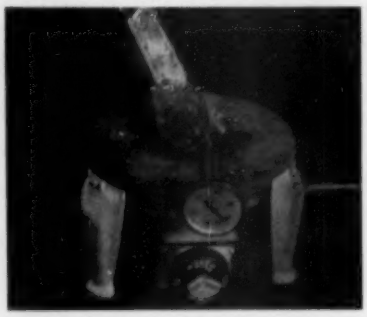
RICHARD O. BRAENDLE joined the Du Pont Company in 1944 after receiving his B.S. degree in Chemical Engineering at Massachusetts Institute of Technology.

He was first assigned to the Grasselli Chemicals Department's Experimental Laboratory in Cleveland. There he did development research on inorganic chemicals, mainly estersils. In 1950, he was transferred to the Du Pont Experimental Station in Wilmington where he worked on the application of estersils as grease thickeners.

He joined the Technical Section of the Petroleum Chemicals Division in 1952, continuing his product development work on estersil GT. During 1955 he did market research analysis for a number of petroleum additives which led to his current assignment as assistant to the sales manager for additives.

During World War II, Mr. Braendle served in the U. S. Army as a researcher and supervisor of a manufacturing operation on the Manhattan Project. He is a member of the American Chemical Society and the American Society of Lubrication Engineers.

RICHARD O. BRAENDLE



ESTERSIL GT greases stand up unusually well even under the combined action of intense heat and vigorous mechanical working.

Excellent heat and shear stability

Estersil greases are non-melting, and extremely wide temperature ranges produce little change in their consistency.

Even under prolonged high-shear, high-temperature operating conditions, greases made with Du Pont Estersil GT show outstanding resistance to mechanical breakdown.

Handling qualities

Greases thickened with estersil can be easily handled in any application—because their unusually high thermal and mechanical stability permits use of a much softer grease.

Estersil greases can be easily made, too. A milling operation is all that is required because of the completely synthetic, preformed thickening structure of estersil GT.

A Du Pont Petroleum Chemicals Division representative will be glad to give you more detailed information on estersil GT. Contact any of our sales offices listed below.

DU PONT
Better Things for Better Living
. . . *through Chemistry*

Petroleum Chemicals

E. I. DU PONT DE NEMOURS & COMPANY (INC.) *Petroleum Chemicals Division* • *Wilmington 98, Delaware*

Sales Offices:

CHICAGO 3 — 8 So. Michigan Ave.	RAndolph 6-8630	PHILADELPHIA 2 — 3 Penn Center Plaza	LOcust 8-3531
CLEVELAND 15 — 25 Prospect Ave.	SUperior 1-1363	PITTSBURGH 22 — Room 751, 1 Gateway Center	ATlantic 1-2933
HOUSTON 2 — 705 Bank of Commerce Bldg.	CApitol 5-1151	SAN FRANCISCO 4 — Room 626, 111 Sutter St.	EXbrook 2-6230
LOS ANGELES 17 — 612 So. Flower St.	MAdison 5-1691	SEATTLE 3 — Room 215, 4003 Aurora Ave.	MElrose 6977
NEW YORK 20 — 1270 Ave. of the Americas	COlumbus 5-2342	TULSA 1 — P. O. Box 730, 1811 So. Baltimore Ave.	LUther 5-5578

IN CANADA: Du Pont Company of Canada Limited—Petroleum Chemicals—85 Eglinton Avenue East—Toronto 12, Ontario—HUdson 1-6461

OTHER COUNTRIES: Petroleum Chemicals Division—Export Sales—Room 7496, Nemours Bldg.—Wilmington 98, Del.—OLympia 4-5121, Ext. 2962

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

A-2826

Printed in U. S. A.

Cast Steel Valves for the Petroleum Industry

are manufactured to meet and exceed the high performance requirements of critical applications. Lunkenheimer Cast Steel Valves provide longer service life and an extra margin of safety through outstanding design features, materials, and workmanship.

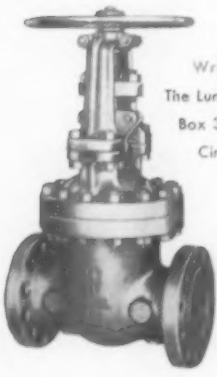
The cost of a Lunkenheimer Valve

gets smaller . . .

and smaller . . . and smaller . . .

with each passing year of dependable service.

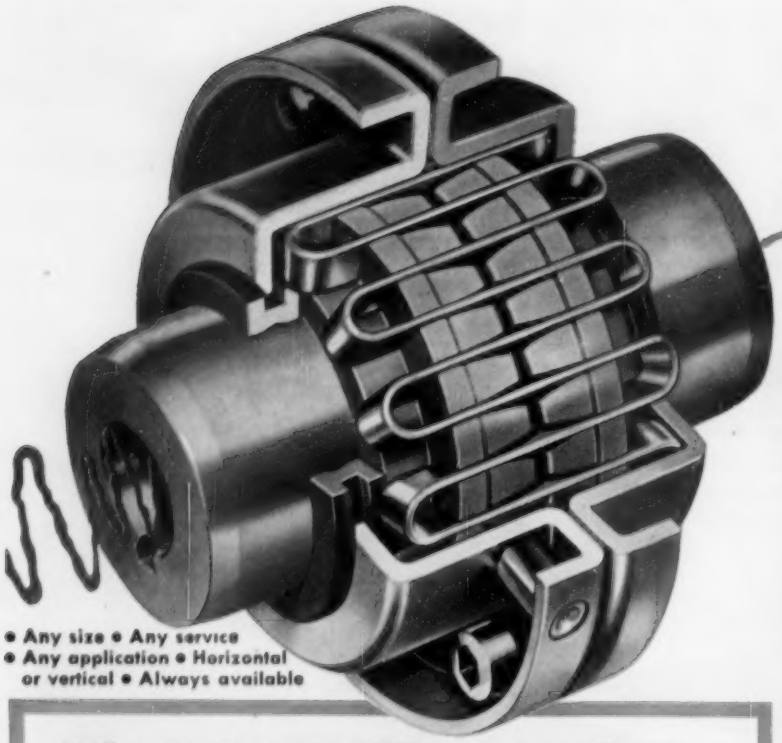
A check on the cost of maintaining your cast steel valves will prove this point.



Write for Literature
The Lunkenheimer Company
Box 360, Annex Station
Cincinnati 14, Ohio

LUNKENHEIMER®

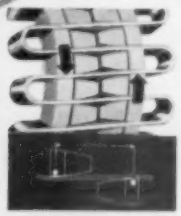
THE ONE *Great* NAME IN VALVES



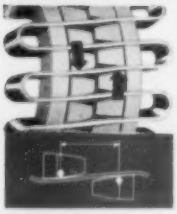
• Any size • Any service
• Any application • Horizontal or vertical • Always available

Exclusive FALK Steelflex grid-groove design smothers shock and vibration.

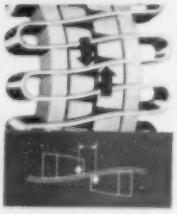
The damaging effects of shock and vibration can shorten the life of any connected machinery. Here is how the Steelflex grid-groove design overcomes these common enemies.



Under LIGHT LOADS
The gridmember bears only at outer edges of grooves. The long span between points of contact remains free to flex under load variations.



Under NORMAL LOADS
As load increases, the distance between supports on the grooves is shortened proportionately, but a free span remains to cushion shock loads.



Under SHOCK LOADS
Under extreme overloads, the grid-member bears fully on the grooves and transmits full load directly. The coupling remains flexible, within its rated capacity.

Why FALK Steelflex Couplings give the *finest* protection for connected machinery

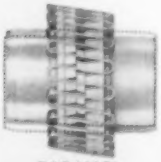
Maximum protection of connected machinery is best provided by Falk Steelflex Couplings because, thanks to their exclusive design, they overcome the damaging conditions of shock loads, shaft misalignment and vibration. How this unique multiple protection is made possible is shown at the right.

Falk Steelflex Couplings give the most economical protection, too, because they make connected machinery last longer and give better service. Furthermore, when actual coupling costs are figured per year of service, Falk Steelflex Couplings show substantial savings through their rugged all-steel construction, easy interchangeability and low maintenance requirements.

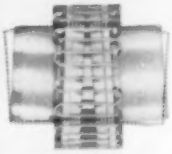
The basic Type F Steelflex Coupling—in 33 sizes to cover capacities from 2/5 through 70,000 hp per 100 rpm—meets over 90% of all industrial applications. Special or Dual Purpose Steelflex Couplings are available for problem applications. Write to Department 247 for engineering bulletin, including selection and dimension details.

...Accommodates shaft misalignment and free end float

Basic maintenance procedure dictates regular inspection and correction of shaft alignment. Between inspections, Steelflex couplings provide protection by accommodating unavoidable shaft misalignment and end float. The gridmember which connects the two hubs of a Steelflex coupling is not fastened to either hub, so each hub can shift without imposing load on the other shaft.



PARALLEL MISALIGNMENT



ANGULAR MISALIGNMENT

FREE END FLOAT

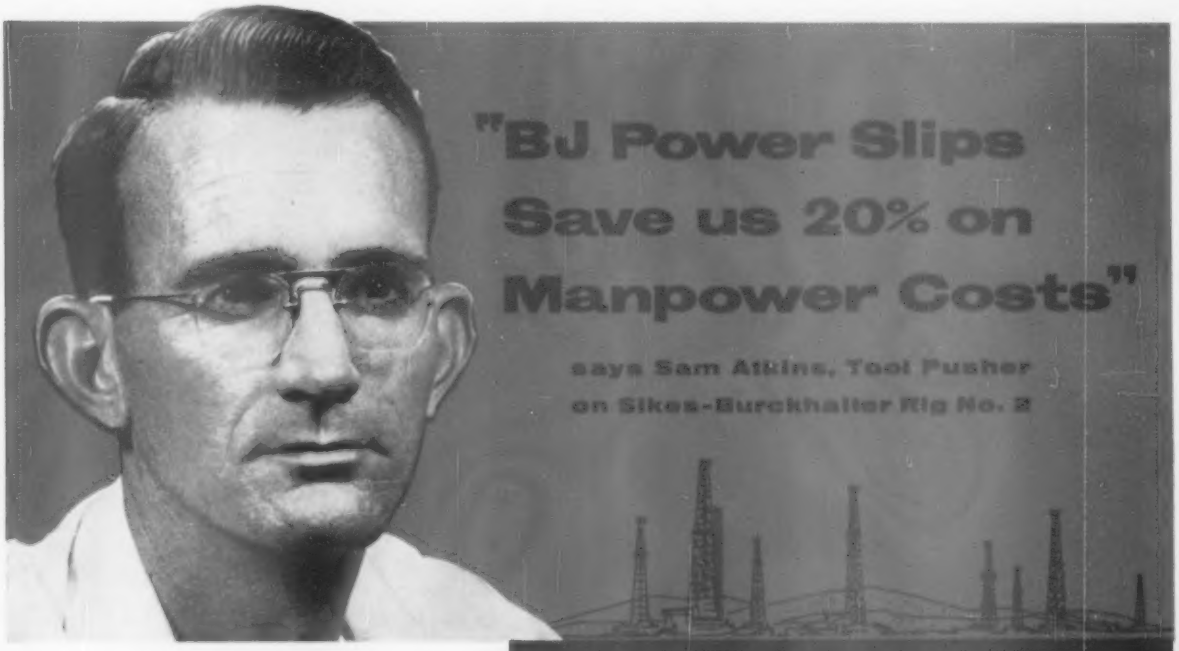
THE FALK CORPORATION, Milwaukee 8, Wisconsin

MANUFACTURERS OF

- Motoreducers
- Speed Reducers
- Flexible Couplings
- Shaft Mounted Drives
- High Speed Drives
- Special Gear Drives
- Single Helical Gears
- Herringbone Gears
- Marine Drives
- Steel Castings
- Weldments
- Contract Machining

FALK

...a good name in industry



"BJ Power Slips are the prime reason for our using only 4-man crews, even on deep holes.

"Our crews like BJ Power Slips because they eliminate the setting and pulling of hand slips on round trips . . . which any roughneck can tell you is hard work. With the BJ Power Slip the men stay fresher, and get us back on the bottom faster, ready to make hole.

"Safety is also a big point. We don't have to worry about the whirling handles of hand slips. And crews are clear of the moving pipe and elevator because slip operations are controlled by the driller.

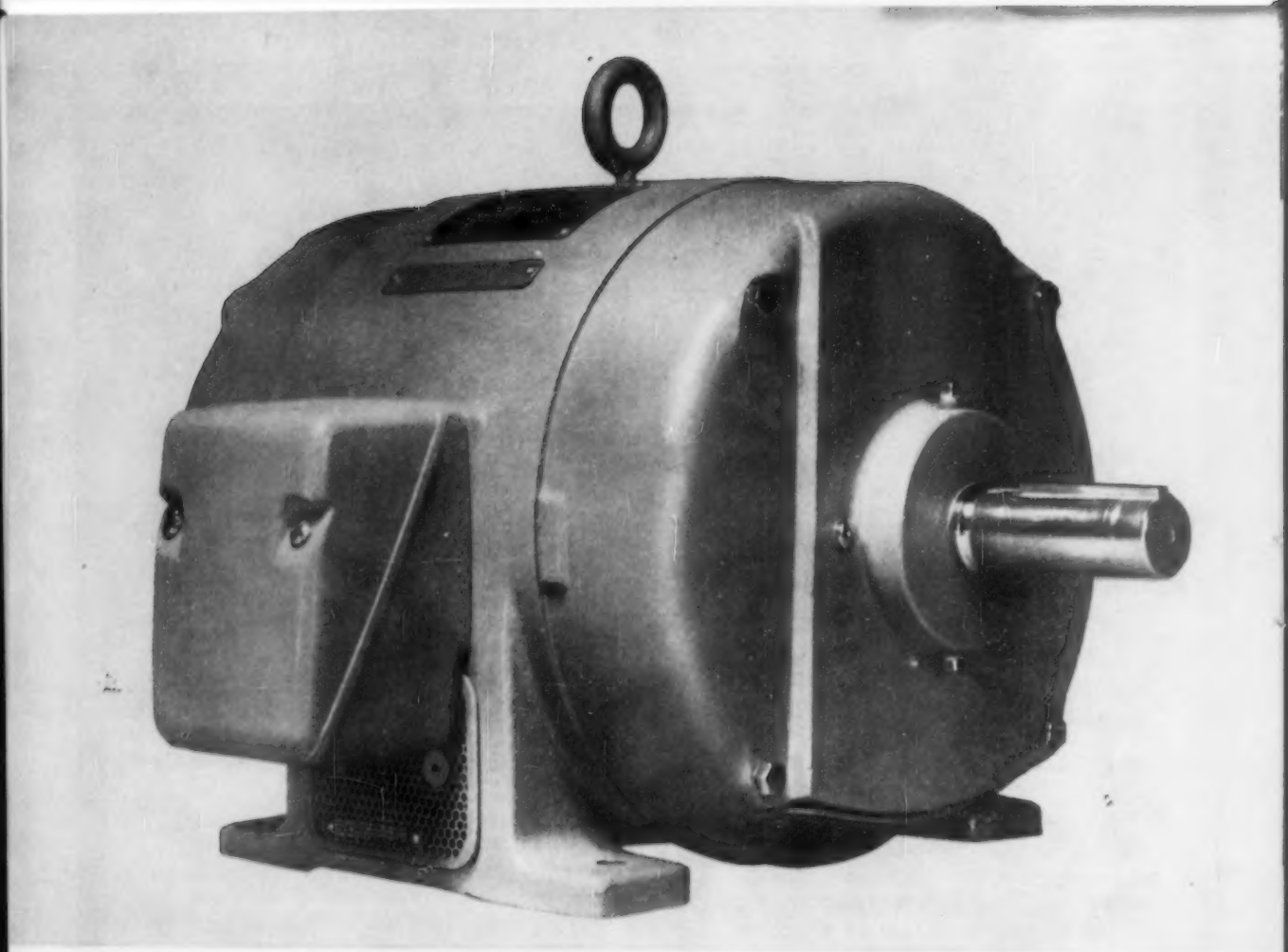
"As a tool pusher I like the fact that these slips don't have to be stripped on and can be swung out of the working area when not in use. Also they have a full opening to pass drill bits, reamers, drill collar stabilizers and centralizers."

Big Benefits of BJ Power Slip

- The only power slip that can be unitized with a rotary table . . . *installed and moved as a unit!*
- Side opening allows the BJ Power Slip to be quickly closed around or removed from the pipe.
- Pressure raised and pressure set by foot pedal control by driller – *automatically* pressure centers the pipe in the table.
- Moves out of the way during drilling. The BJ Power Slip swings away from the rotary table and can be positioned out of the working area.
- Automatic safety features. A built-in pressure relief valve automatically relieves air pressure in power cylinder if elevator accidentally strikes arm ring of Slip. A pilot-operated safety valve automatically holds Slip in "up" position in the event of an air line failure.

Byron Jackson Tools, Inc.
A Subsidiary of Borg-Warner Corporation
P. O. Box 2017A Terminal Annex, Los Angeles 54, California
Export Address: 580 Fifth Avenue, Suite 510, New York 36, New York
Offices in Houston, Fort Worth, Denver and New York. Sales Engineers in all Principal Oil Fields.

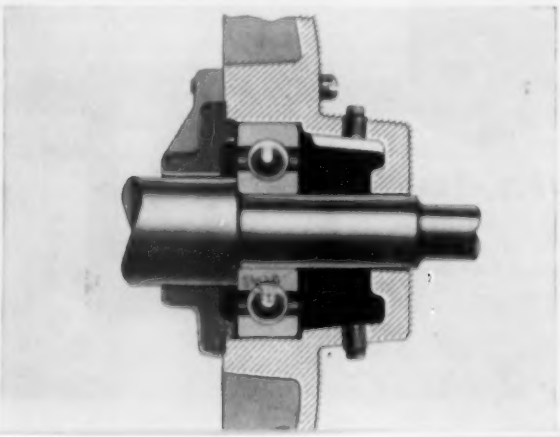
BJ



General Electric's NEW

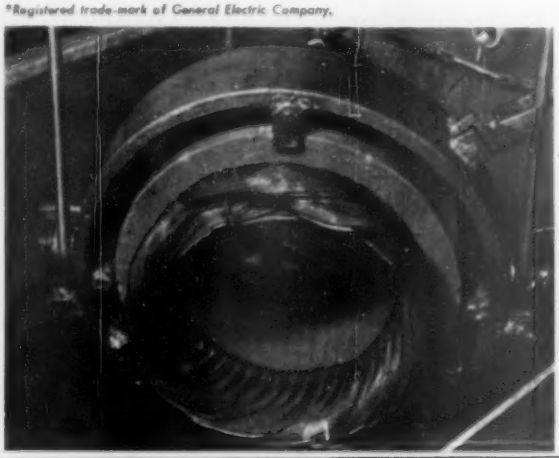
INSTALL IT...

DUST PROTECTION—Closely machined bearing caps and housing on each side of bearings, plus the new G-E Tri-Clad "55" oil field motor's low velocity air intake system, keep dirt and dust out of vital parts, help give added protection for longer, trouble-free operation.

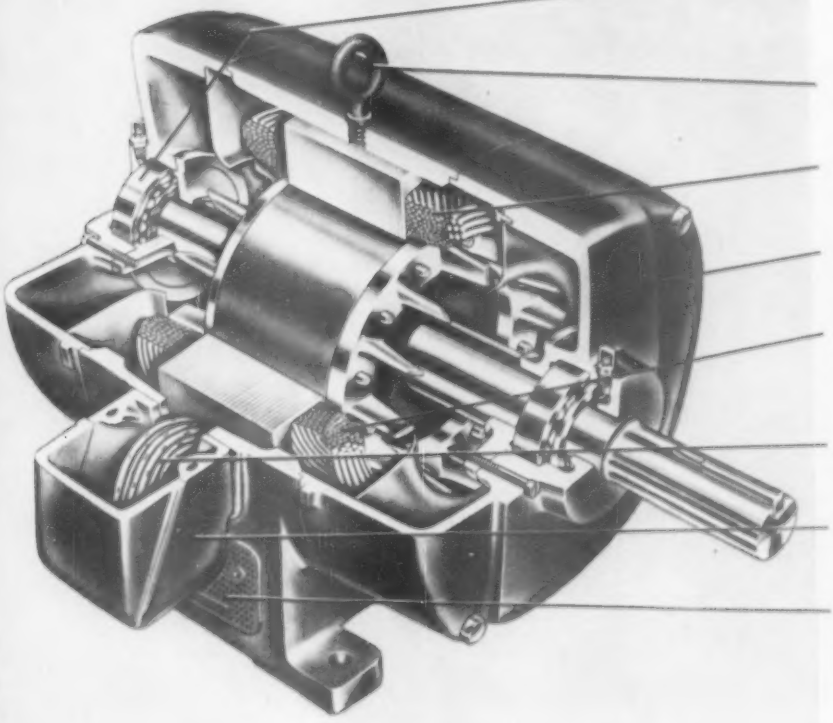


MOISTURE PROTECTION—Field windings, coated with water-shedding silicone Dri-Film*, plus cast-iron frame construction and close fits between all joining surfaces, help prevent motor failure due to moisture.

*Registered trade-mark of General Electric Company.



PACKED WITH MONEY-SAVING FEATURES



1. Advanced bearing system will last longer without regreasing than any other motor bearing system.

2. Convenient eyebolt cuts installation time, —permits easier handling.

3. Water-shedding stator windings virtually eliminate breakdown due to moisture.

4. Rugged cast-iron frame helps prevent corrosion and accidental damage.

5. Class 'B' insulation system with revolutionary Alkanex* wire enamel allows up to 40% higher temperature rise.

6. Perma-numbered leads are easy to read even when taped or clipped.

7. Easy-access conduit box is large and roomy for fast wiring.

8. Removable screens protect motor against damage from rodents and rocks.

*Registered trade-mark of General Electric Company.

TRI 55 CLAD oil field motor

REG U.S. PAT OFF.

FORGET IT!

General Electric's all-new Tri-Clad "55" oil field motor is specially designed and engineered for long, trouble-free operation on rugged, outdoor pumping applications.

This motor will run far longer without attention than ordinary motors because it is protected against dust and moisture. Also, burnouts have been virtually eliminated by the use of Class 'B' insulation made from new "miracle" materials Alkanex, heat-resistant enamel wire, and Mylar† mica-glass laminate slot and phase insulation.

The high heat resistance of this new insulation means you get more horsepower per pound in a more compact, cast-iron frame, because of higher temperature protection possible with Alkanex. The large grease reservoir and revolutionary bearing system has reduced normal maintenance to a few minutes every five years.

The eyebolt, large roomy conduit box and perma-numbered leads—"extras" at no extra cost—cut installation time to a minimum.

A new G-E oil field motor for your pumping application is easily your most economical buy. Install it...forget it. For more information write for Bulletin GEA-6546 or contact your nearest General Electric Motor Distributor, or G-E Apparatus Sales Office.

†DuPont trade-mark 877-1

MEDIUM INDUCTION MOTOR DEPARTMENT

Schenectady 5, New York

Progress Is Our Most Important Product

GENERAL ELECTRIC

If you paid us a visit with your Wickwire Rope Distributor...

(and we hope you do)

... you'd see skilled craftsmen like these—men who are helping produce top-quality Wickwire Rope, Slings and Strand. You'd find:

the **MELTER**, who compounds the steel with the sharp eye of an expert

the **DIE MAKER**, who prepares the dies needed to produce the right wire

the **CLOSER OPERATOR**, who skillfully fabricates the wire rope

the **METALLURGIST**, who certifies that the wire has the proper physical and chemical properties

the **SALES ENGINEER**, who's always ready to help you

and ***many others*** like them who are constantly working to keep Wickwire in its position of leadership in the production of top-quality products.

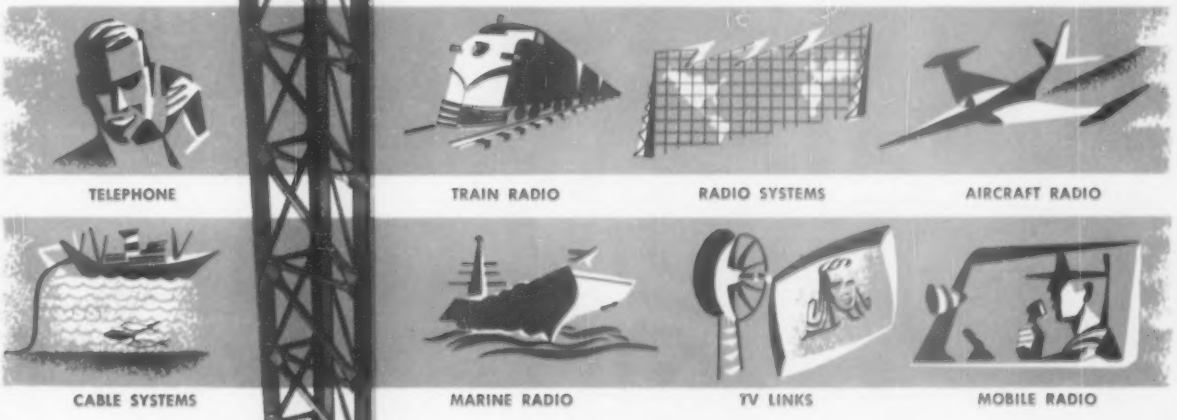
They're all good reasons why your Wickwire Distributor knows he's got top-quality wire rope, slings and strand to sell ... and that these products will serve you well.

4087

A PRODUCT OF THE COLORADO FUEL AND IRON CORPORATION

Behind *Federal* MICROWAVE

—the world's most comprehensive communications experience



Federal, through IT&T's global background in research, engineering, manufacturing and system operation, brings you...
"MICROWAVE AT ITS BEST"

No other microwave system is backed by communications experience so broad and diversified as that of Federal's parent company . . . the world-wide International Telephone and Telegraph Corporation.

IT&T *pioneered* microwave . . . IT&T *knows* communications . . . from the simplest inter-office dial telephone system to intercontinental radio and cable companies serving every corner of the earth. This vast, collective experience, covering system *manufacturing* and system *operation*, is the *plus value* you get *only* with Federal Microwave!

Federal is the system especially designed for pipelines, railroads, utilities, telephone companies, municipalities, highways, TV stations and others . . . meeting every need for high-quality operation of communications, supervisory and control functions.

Whatever your distance, terrain or circuit requirements . . . look to Federal for microwave systems of maximum versatility and dependability . . . built by communications experts . . . and *"Certified by a World of Research."*

Write to Dept. H-832

Federal
A DIVISION OF IT&T

Federal Telephone and Radio Company
A Division of
International Telephone and Telegraph Corporation
100 KINGSLAND ROAD • CLIFTON, N. J.

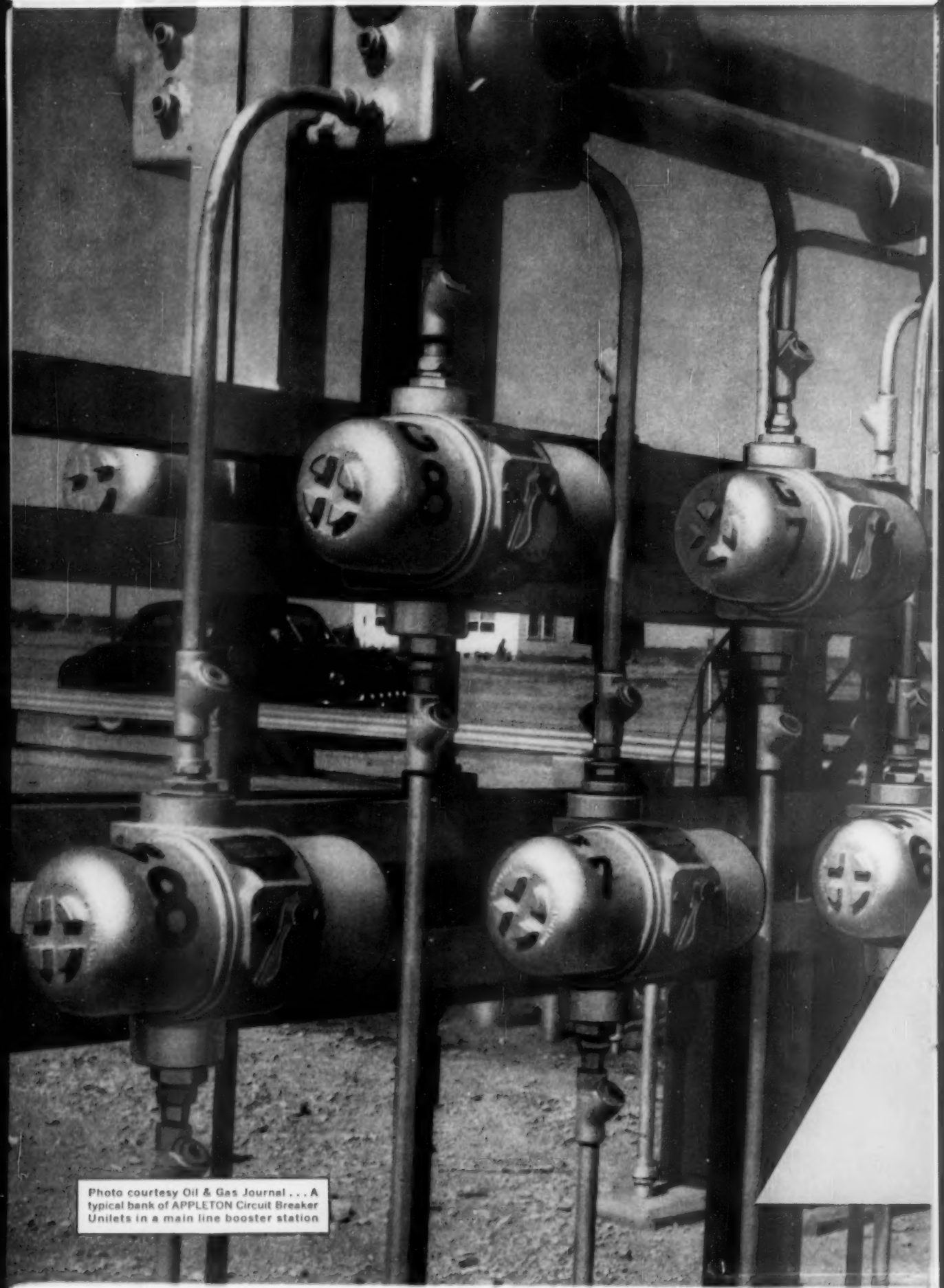


Photo courtesy Oil & Gas Journal . . . A typical bank of APPLETON Circuit Breaker Unilets in a main line booster station

The Choice of America's Leading Electrical Engineers

APPLETON

CIRCUIT BREAKER, MOTOR STARTER and COMBINATION MOTOR STARTER

UNILETS®

APPLETON Circuit Breaker and Motor Starter Unilets . . . your best choice for positive lasting protection against explosion, dust, and rain! Regardless of the installation, where absolute safety is required . . . APPLETON can serve you better!

7 REASONS FOR APPLETON SUPERIORITY

1. Full 7-thread explosion-proof protection. 2. Unmatched accessibility. 3. Compact, lightweight construction. 4. Unit may be added quickly, easily. 5. Flexible field set-ups with single and duplex male and female hub adapters. 6. Combinations meet U.L. requirements through approval of components. 7. First to be U.L. approved for banked circuit breaker grouping.

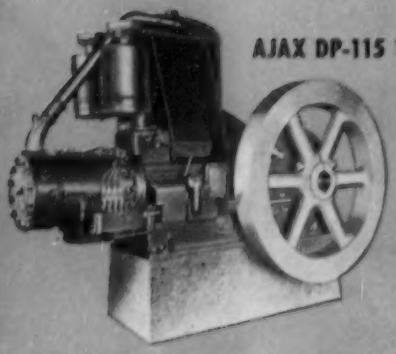
SOLD EXCLUSIVELY THROUGH SELECTED WHOLESALERS.
AN APPLETON ENGINEER WILL HELP YOU PLAN YOUR INSTALLATIONS WITHOUT OBLIGATION.

Also Manufacturers Of:

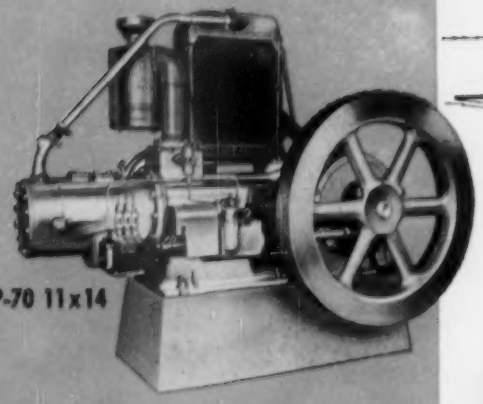
APPLETON ELECTRIC COMPANY • 1718 Wellington Avenue • Chicago 13, Illinois

APPLETON ELECTRIC PRODUCTS

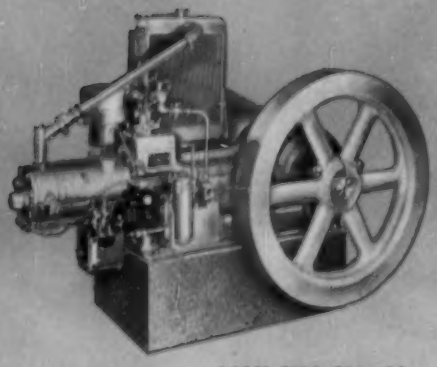
Rely on APPLETON... The Standard for Better Wiring®



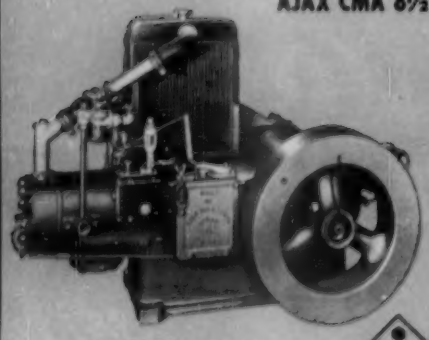
AJAX DP-115 13¼x16



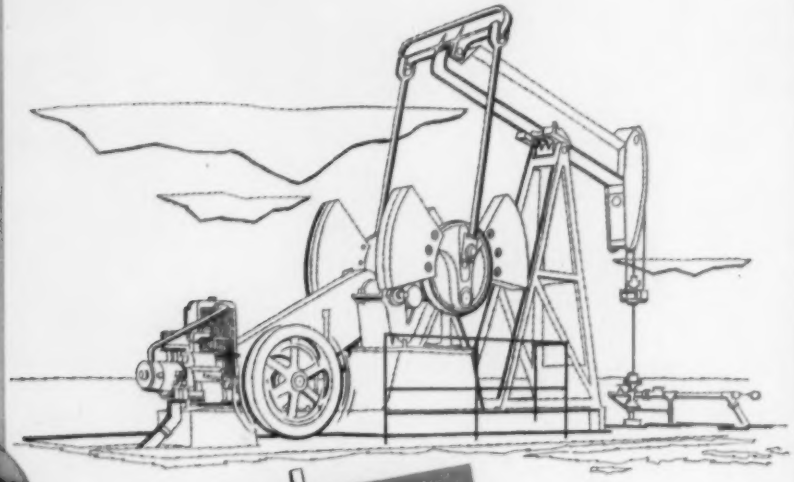
AJAX DP-70 11x14



AJAX CMA 8½x10



AJAX WL 5x6½



you get

Cheap Power

with QUALITY GAS ENGINES

by *Ajax*

CHEAP POWER makes money for you . . . costly power drains it away. You can figure your savings with AJAX AND GAS in terms of gas vs. purchased power costs in *your* locality—delivered to *your* wells—consumed on *your* jobs. (Or send us the data and we'll do the work!) • When you see the solid money difference, see your Supply Man, fast!

AJAX

AJAX IRON WORKS

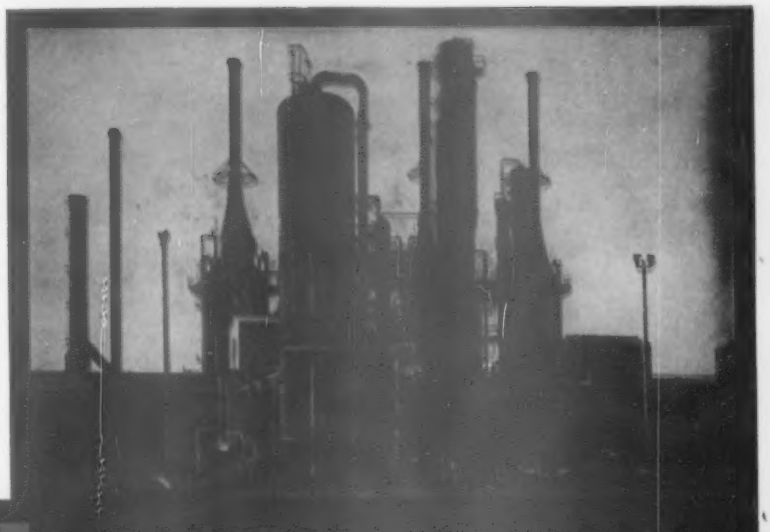
Builders of GAS AND OIL ENGINES, PRESSURE PUMPS, STEAM DRILLING ENGINES, INDUSTRIAL STEAM ENGINES

CORRY, PENNSYLVANIA

Oil Field Distributors: THE NATIONAL SUPPLY CO., PITTSBURGH, PA.
T. B. MOORE SUPPLY CO., BOLIVAR, N.Y. - BETHLEHEM SUPPLY CO., TULSA, OKLAHOMA

TO INSURE

smooth operations
more time on stream
lower operating costs
better products



TRETOLITE REFINERY SERVICES

DESALTING

CORROSION PREVENTIVES

FUEL EMULSION PREVENTIVE

METAL DEACTIVATOR

Desalting the crude charge before refining is now accepted as standard operating procedure. Desalting removes salts which evolve into corrosive acids. It prevents salt plugging of condensers, exchangers and towers, and keeps solids and fines from entering the refinery. Tretolite desalting is an automatic, all chemical process, consistently delivering salt removals in the 98 to 100% range.

Kontol Corrosion Preventives combat internal corrosion, hydrogen blistering, fouling and scaling. They are organic semi-polar liquids which protect by adsorbing at metal surfaces as a tough, impervious film. They are readily adsorbed from dilute hydrocarbon solutions to form this film. In addition to their corrosion preventive properties, the Kontols are powerful detergents which clean and de-foul refining equipment.

Tretolite Fuel Emulsion Preventive is an organic, oil-soluble agent designed to prevent the emulsification and sludging of burning oils and diesel fuels. Oils treated with Tretolite Fuel Emulsion Preventive have shown no sludge formation even after a three month settling test.

Kuplex Metal Deactivator effectively deactivates copper in hydrocarbons such as gasoline, kerosine, jet fuel, diesel oil, furnace oil and turbine oil. Its powerful chelating action prevents hydrocarbon deterioration caused by metal catalyzed oxidation.

For complete information, technical data and prices, ask your Tretolite refinery service engineer or write to –

TRETOLITE COMPANY
A DIVISION OF PETROLITE CORPORATION
369 Marshall Avenue, Saint Louis 19, Missouri
5515 Telegraph Road, Los Angeles 22, California

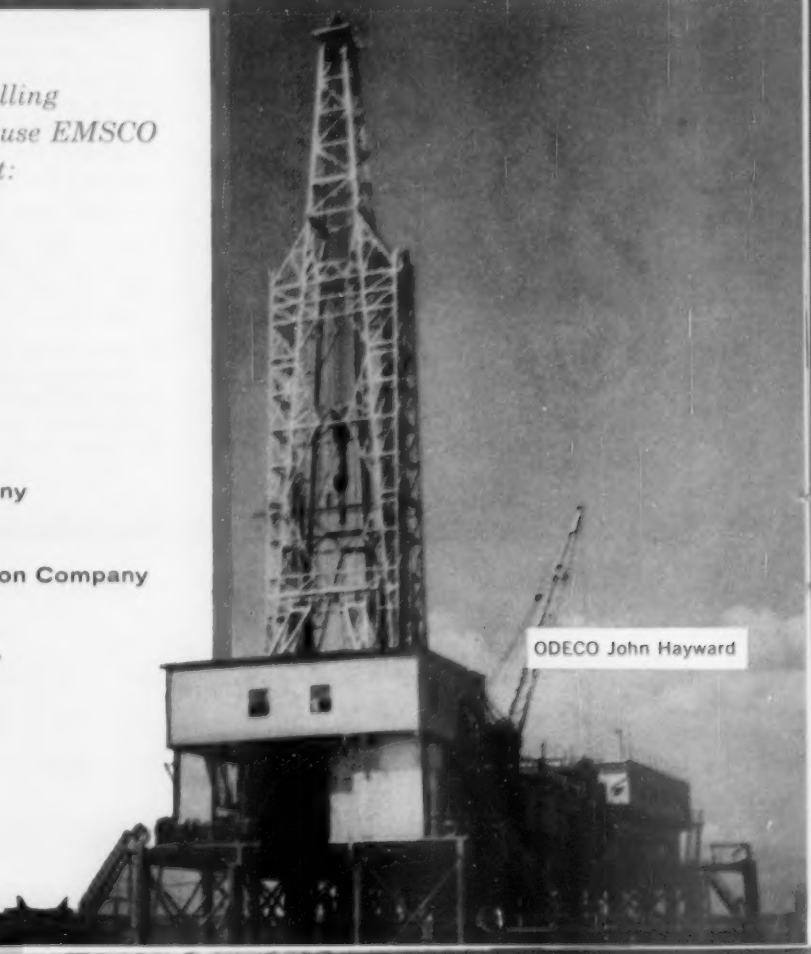
TR 56-12

Chemicals and Services for the Petroleum Industry

DESALTING • DEMULSIFYING • CORROSION PREVENTING
SCALE INHIBITING • FUEL OIL ADDITIVES • WATER
DE-OILING • PARAFFIN REMOVING • PRODUCTION
STIMULATING • BACTERICIDES • METAL CONDITIONERS

These foremost offshore drilling contractors and companies use EMSCO drilling rigs and equipment:

American Tidelands, Inc.
Big Chief Drilling Company
Delta Drilling Company
Delta Gulf Drilling Company
Delta Marine Drilling Company
Kerr-McGee
Ocean Drilling and Exploration Company
Penrod Drilling Company
Phillips Petroleum Company
Wheless Drilling Company



OFFSHORE DRILLING

Offshore deep drilling is simplified through modern rugged Emsco drilling machinery. The Emsco all-electric "E" series rig is the very latest in a single package with integral motors according space-saving economy in a compact deep drilling rig. PJ 27½ cone roller bearing rotary table, L-400 heavy duty true cone roller bearing swivel, MA series crown and traveling blocks are all companion equipment capable of handling offshore deep drilling responsibilities twenty-four hours a day. Continuous uninterrupted service means an economical profitable well completion to both the operator and contractor.

Check these outstanding "E" Rig Features

1. Four Speed Drawworks 2. Built-in electric motor package 3. Totally enclosed pressure lubricated drives 4. 60" brake rims with total effective braking area of 2,640 square inches 5. Optional built-in Sandreel

For complete information and engineering data, call Continental today

CONTINENTAL

Serving the Oil and Gas Industries

CONTINENTAL SUPPLY COMPANY

A Division of The Youngstown Sheet and Tube Company

General Offices: Dallas, Texas

Representatives in all principal oil fields of the world

QUALITY IS OUR PRODUCT

EMSCO

TRADE MARK

EMSCO MANUFACTURING COMPANY

Garland, Tex. • LOS ANGELES, CALIF. • Houston, Tex.

General Sales Offices: Dallas, Texas

R-605

SUPPLY BOVAIRD COMPANY

TO GET WHAT YOU WANT
WHERE YOU WANT IT
WHEN YOU NEED IT...
AT REASONABLE
COMPETITIVE PRICES

OFFICES AND STORES

COLORADO—Denver
ILLINOIS—Clay City, Grayville, Mt. Vernon, Salem
KANSAS—Chase, Great Bend, Liberal, Pratt, Russell, Wichita
NEW MEXICO—Lovington
OKLAHOMA—Duncan, Oklahoma City, Pauls Valley, Pawhuska, Sapulpa, Seminole, Tulsa
TEXAS—Abilene, Borger, Dallas, Houston, Midland, Odessa, Pampa

PESA
PARTNERS IN PETROLEUM PROGRESS

"Buy From Bovaird"

THE Bovaird SUPPLY COMPANY

GENERAL OFFICES
TULSA, OKLAHOMA

55 YEARS OF PROGRESS WITH THE OIL INDUSTRY

Representatives in all principal oil fields of the world

IT'S MORE THAN A SIGN OF QUALITY

it's a symbol of over 20 years' service to the gas-treating industry

MONOETHANOLAMINE
DIETHANOLAMINE 〉 **for H_2S and CO_2 removal**

DIETHYLENE GLYCOL
TRIETHYLENE GLYCOL 〉 **for H_2O removal**

Yes, you get more than the best gas-treating chemicals at CARBIDE. You also get these *extra* benefits.

- the services of CARBIDE technical representatives.
- laboratories that devote a great deal of time to advancing knowledge in this field.
- the "know-how" accumulated over more than twenty years by the first producer of these chemicals.
- a national distribution network of 49 warehouses and 14 bulk storage depots to assure you of continuous supply and rapid delivery. Shipments are made in tank cars, tank wagons, and drums in carload or truckload lots.

CARBIDE and CARBON CHEMICALS COMPANY

A Division of
Union Carbide and Carbon Corporation
30 East 42nd Street, New York 17, New York
Offices in Principal Cities

NEW! PHILCO

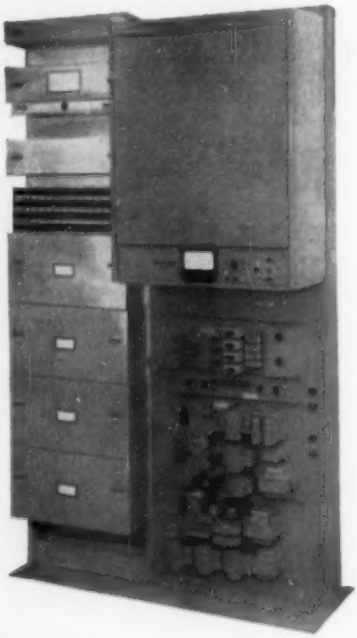
HERE are new Microwave "Packages" by Philco, pioneer in the design and manufacture of microwave systems. Each new package incorporates advanced techniques in communications and control. All components have been selected for superior performance and greatest reliability. Outstanding features of Philco Microwave Packages can lower your installation and operating costs; write Philco now for complete information.

PHILCO Series 500

Philco Series 500 Package is designed primarily for pipe line and railroad companies requiring maximum dependability consistent with highest commercial performance standards along extensive right-of-way routes.

FEATURES

- Expandable to 24 or more channels (plus service channel)
- Extendable to 40 hops (1000 miles)
- Commercial quality circuits



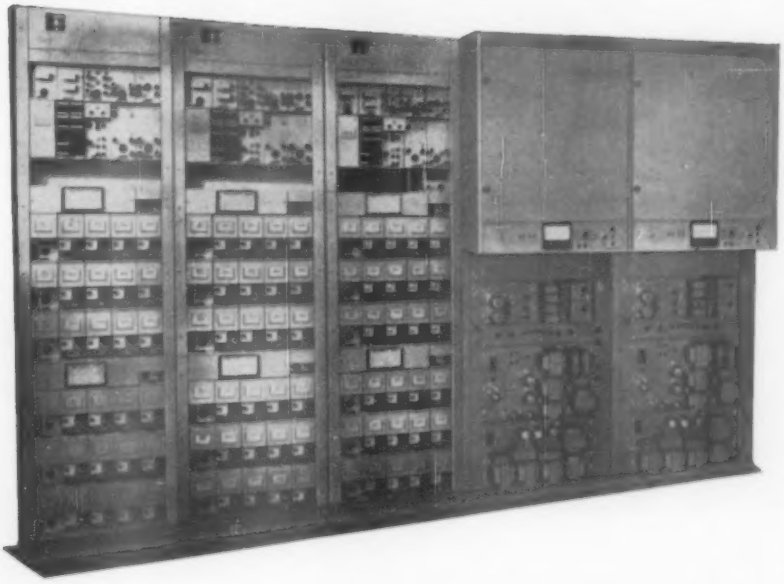
PHILCO Series 120

Philco Series 120 Package is designed to provide low cost, reliable communications over moderate distances for turnpikes, police, and utilities.

FEATURES

- Lowest cost per channel mile
- Expandable to 24 or more channels (plus service channel)
- Extendable to 10 hops
- Commercial quality circuits

Microwave "Packages"



PHILCO Series 90

Philco Series 90 Package is designed to provide the high performance and reliability required by common carriers and government agencies. Full 100% standby with completely automatic switching is included.

FEATURES

- Utmost reliability
- Expandable to 60 channels
- Extendable to 5 or more hops

Philco maintains a staff of experienced engineers to conduct surveys, plan, and install complete systems to satisfy even the most complex communications requirements. These men have successfully completed thousands of system miles, including one of the longest microwave communications systems in the world.

Write to Dept. OG for New Free Booklet

PHILCO
Famous for
QUALITY
the World Over

PHILCO CORPORATION

GOVERNMENT AND INDUSTRIAL DIVISION • PHILADELPHIA 44 PENNSYLVANIA

In Canada: Philco Corporation of Canada, Limited, Don Mills, Ontario

The REFINERY ENGINEERING Company's horizons are greatly expanded. Treco is now in position to offer engineering, design and construction of refineries, chemical plants, ore processing, secondary recovery and gas processing facilities on a world-wide basis.

The company has greatly enlarged engineering resources, research and development laboratories and a rapidly expanding staff. This enables The REFINERY ENGINEERING Company to offer a *complete service* to nearly all types of industries.

Treco has just produced a brochure which shows the Company's facilities with photographs of completed projects. A copy will be mailed you promptly upon request on your company's letterhead.

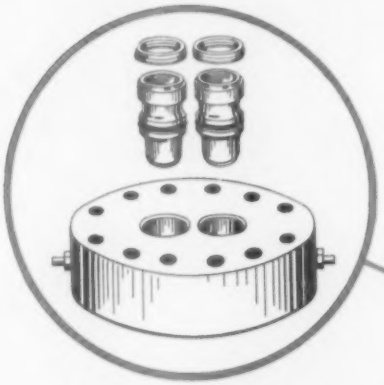
A DIVISION of VITRO CORPORATION of AMERICA

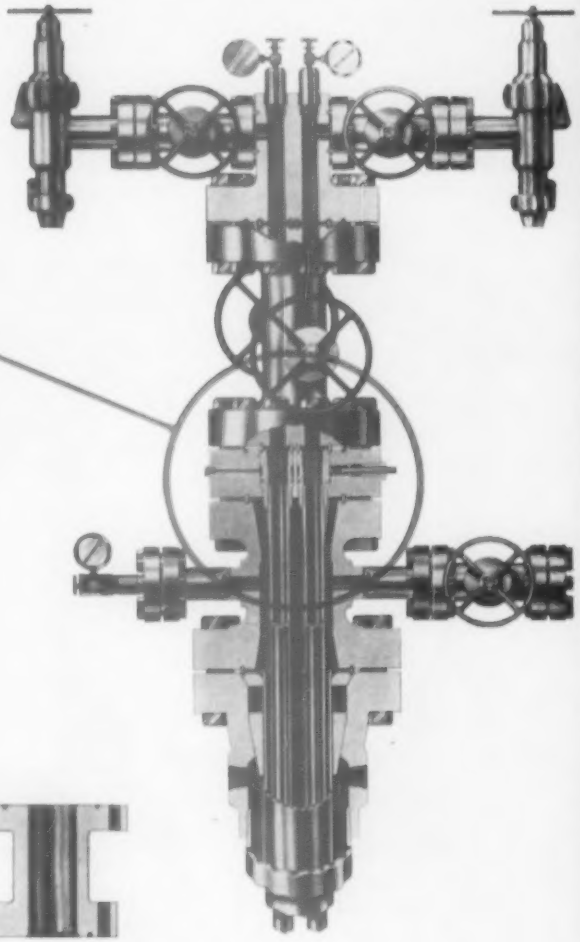
The REFINERY ENGINEERING Company

NEW YORK TULSA TORONTO

RECTOR Dual-String Hanger Flange

Outstanding Simplicity and Flexibility, plus the FAMOUS Rector Metal-to-Metal Seal





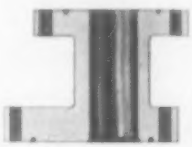
SIMPLICITY: The flange has two full opening tapered bores in which the strings are suspended by threaded mandrels. This eliminates mating and sealing two tubing hangers in a single, large bore. Each string can be suspended, temporarily sealed, and held down independently of the other assuring maximum ease of installation with complete control of well.

FLEXIBILITY: Regular 2" API upset tubing can be run or pulled through the bores in the flange.

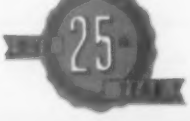
METAL-to-METAL SEALS: Each mandrel is independently sealed by a metal seal ring in the groove at the junction of mandrel and flange. This metal-to-metal sealing arrangement also acts as a hold-down. "O" Rings on the mandrel provide a temporary seal during completion and permit testing the seal after Christmas Tree is installed. Mandrels are grooved for hold-down locking screws, which are optional in the flange.

- **Rector Dual-String Hanger Flanges are available in Nom 6 and Nom 8 sizes in any series. Mandrels are interchangeable.**

For maximum simplicity and flexibility of dual-string suspension, plus the metal-to-metal seal that never requires maintenance or replacement, specify a Rector Dual-String Hanger Flange in your dual completion Christmas Tree.



Off-Set Adapter Spool permits use of regular preventer equipment with alignment directly over each individual bore while running and pulling tubing. After first string is run, Adapter Spool can be rotated to center directly over the other bore.



RECTOR WELL EQUIPMENT COMPANY INC
MAKING THE OIL INDUSTRY SAFER
1100 NORTH COMMERCE ST. FORT WORTH, TEXAS
Houston Plant: 2215 Commerce St.
REPRESENTATIVES IN ALL ACTIVE FIELDS

2 BIG REASONS WHY MAJOR PIPELINES

1 LOW MAINTENANCE. Bingham Pipeline Pumps are of "Double Volute" design, insuring perfect hydraulic radial balance of rotating element. "Hydraulic Radial Balance" eliminates unequal pressures on the rotating element—**"Side Push"**—which is the primary cause of wear and maintenance in conventional pumps. Also this feature, which eliminates shaft deflection, permits **mechanical seals** to establish and maintain uniform track between the contacting faces. This prevents leakage and seal face wear, resulting in *long seal life.*

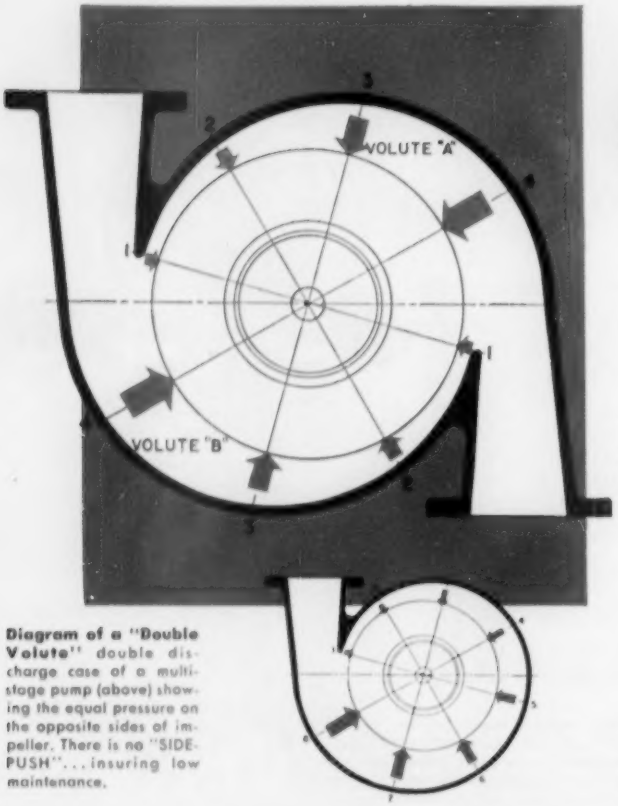
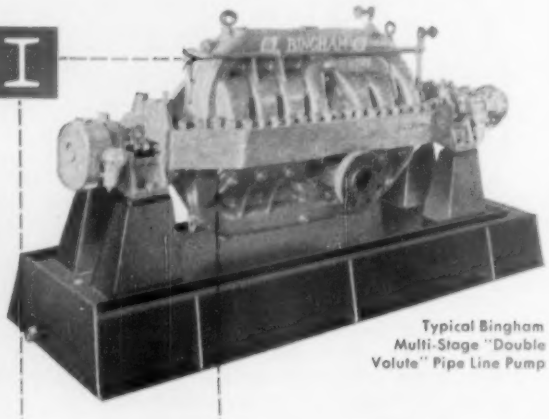


Diagram of a "Double Volute" double discharge case of a multi-stage pump (above) showing the equal pressure on the opposite sides of impeller. There is no "SIDE-PUSH"... insuring low maintenance.

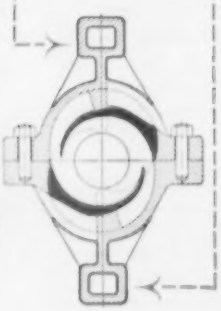
Diagram of "Single Volute" pump case (immediately above) showing unequal pressures at opposite points around the periphery of the impeller. These unequal pressures cause "SIDE-PUSH" on the rotating elements, causing wear of rotating parts and, frequently, high maintenance.

2 ASSURED CASE STRENGTH FOR HIGH-PRESSURE SERVICE

I



Typical Bingham Multi-Stage "Double Volute" Pipe Line Pump



A transverse cross-section of Bingham "Double Volute" Multi-Stage Pumps, showing identical cross-overs cast integrally with the upper and lower halves of the pump casing.

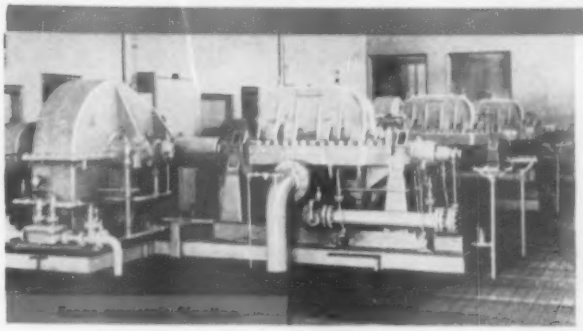
Integral cross-overs in Bingham "Double Volute" multi-stage pumps produce casings of maximum strength for high pressure service because each cross-over is cast integrally with its half of the pump casing, and thereby becomes a structural member of Bingham's "I-Beam Truss Construction".

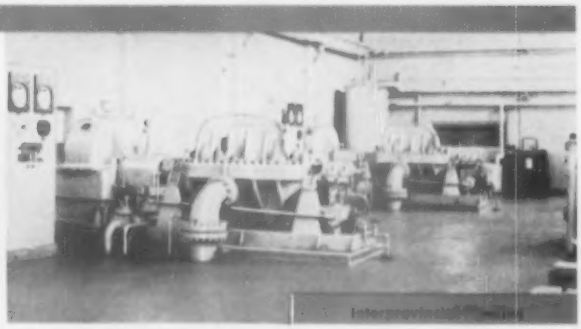
This feature, found only in Bingham pumps, increases the strength of the pump casing to such an extent that it can safely withstand operating pressures up to 2000 psi with standard construction (higher pressures with special construction).

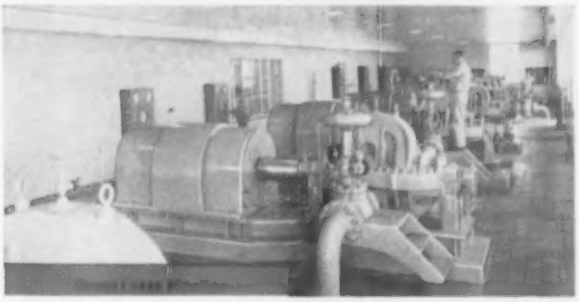
Bingham "Double Volute" Multi-Stage Pumps will best serve your pipeline operations, as they are now serving major pipelines. Write to your nearest Bingham office for "Double Volute" Bulletin or additional information.

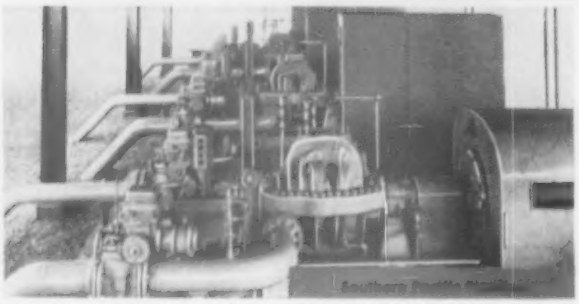
SELECT *Bingham*

. . . "DOUBLE VOLUTE" PUMPS









PARTIAL LIST OF MAJOR PIPELINES WITH BINGHAM "DOUBLE VOLUTE" PUMPS IN OPERATION OR ON ORDER

Brazilian Gov't Pipeline
Buckeye Pipeline
Cherokee Pipeline
Great Lakes Pipeline
Interprovincial Pipeline
Interstate's Pipeline
Kaneb Pipe Line
Lakehead Pipeline
Mackinac Pipe Line
Magnolia Pipeline
Minnesota Pipeline
Okla.-Miss. Pipeline
Pasotex Pipe Line
Pembina Pipeline
Pemex Pipeline
Plantation Pipeline
Service Pipeline
Southern Pacific Pipeline
Spanish Air Base Pipeline
Standard Oil of Indiana Pipelines:
1. Dubuque-Moorhead Pipeline
2. Mandan-Moorhead Pipeline
3. Whiting-River Rogue Pipeline
Sun Pipeline
Tidewater Assoc. Pipeline
Trans-Mountain Pipeline
Trans-Northern Pipeline
Tuscarora Pipe Line
Union Oil Pipeline
Western Pipeline
Yellowstone Pipe Line

Bingham SINCE 1921

DOUBLE VOLUTE PUMPS RADIAL BALANCE

BINGHAM PUMP COMPANY
General Offices: 2800 N.W. Front Avenue, Portland 10, Oregon
Factories: Portland, Ore. • Vancouver, B. C., Canada

SALES AND SERVICE OFFICES

BOSTON, MASS.
CHICAGO, ILL.
CLEVELAND, OHIO
DALLAS, TEXAS
DENVER, COLO.
HOUSTON, TEXAS
KANSAS CITY, MO.
LOS ANGELES, CALIF.
NEW ORLEANS, LA.
NEW YORK CITY, N.Y.
PHILADELPHIA, PA.
PITTSBURGH, PA.
SAN FRANCISCO, CALIF.
SEATTLE, WASH.
ST. LOUIS, MO.
ST. PAUL, MINN.
TULSA, OKLA.
TORONTO, ONT., CAN.
VANCOUVER, B. C., CAN.

"All UNIONS aren't the same -- specify WECO by name"

Examine a WECO Union and you will see that all unions are not the same.

The difference is readily noted in WECO'S metal-to-metal ball and cone seat that is unequaled for positive, leak-proof sealing under the severest conditions.

The ease and speed of repeated make-up and break-out is apparent in the sturdy, accurately cut Acme threads.

The extra strength of WECO Unions is evident in the heavier wall sections that are machined and knurled for uniform wall thickness and safer wrenching . . . in the sturdy wing nut that takes heavy hammering as a matter of course.

These differences in design and construction make WECO Unions superior in sealing and economical in service. That's why it pays to specify WECO Unions by name, from supply stores everywhere.

U-13-66

WECO®

WELL EQUIPMENT MFG. CORP.
HOUSTON, TEXAS

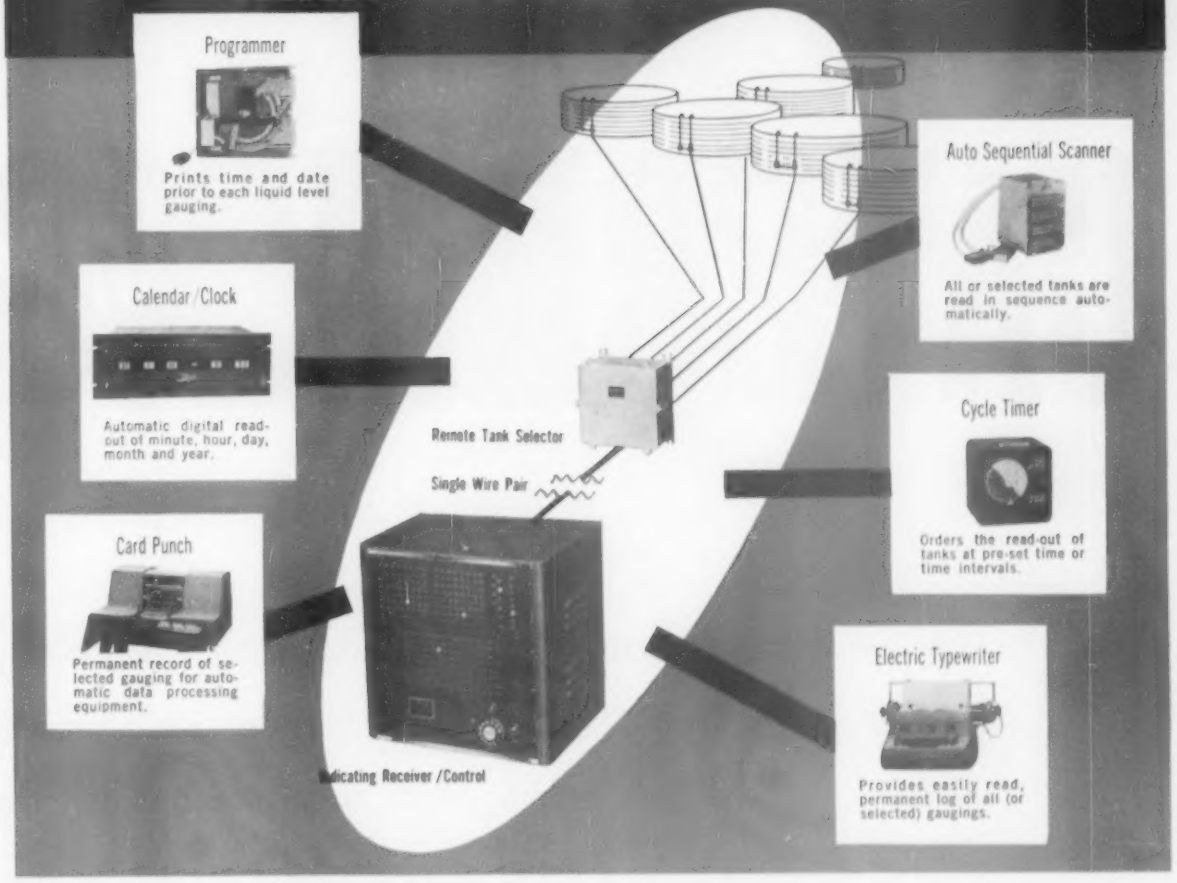
Division of CHIKSAN COMPANY *a subsidiary of*
FOOD MACHINERY AND CHEMICAL CORPORATION

PESA

fmc

Bendix-Pacific ELECTRO-SPAN

GIVES YOU THE MOST VERSATILE TANK GAUGING SYSTEM


Programmer
Prints time and date prior to each liquid level gauging.
Calendar / Clock
Automatic digital read-out of minute, hour, day, month and year.
Card Punch
Permanent record of selected gauging for automatic data processing equipment.
Auto Sequential Scanner
All or selected tanks are read in sequence automatically.
Cycle Timer
Orders the read-out of tanks at pre-set time or time intervals.
Electric Typewriter
Provides easily read, permanent log of all (or selected) gaugings.
Remote Tank Selector
Single Wire Pair
Indicating Receiver / Control

With Electro-Span Gauging Systems you can secure *any* arrangement of a basic system — together with a unique selection of input and readout equipment — to meet virtually every requirement.

The Electro-Span System is an expensive digital pulse-code system for the measurement and control of any number of tanks. Tank levels to ⅛", and averaging temperatures if desired, are displayed on lamp registers.

In addition, all of the important accessories shown above can be provided to give you the most complete tank gauging system available today.

Write Pacific Division, Bendix Aviation Corp., Department 432, North Hollywood, Calif., for Bulletin ES-5A or contact Instruments, Inc., P.O. Box 556, Tulsa, Oklahoma.

Bendix
PACIFIC DIVISION
Bendix Aviation Corporation
NORTH HOLLYWOOD CALIF

Export—Bendix International: 205 E. 42nd St., New York 17

Canadian—Computing Devices of Canada, Ltd., P.O. Box 508, Ottawa 4

NOW! A CATFORMING

Here's important news for refiners who are finding it increasingly difficult to meet today's higher octane requirements with present processes and catalysts. Atlantic offers an advanced Catforming catalyst designed to do a better, more economical job. The new catalyst combines ability to make higher octane quality products and an improved stability. These catalyst qualities mean greater process flexibility, and they are applicable in your present equipment. For full information on Catforming, write, wire or call The Atlantic Refining Company, P.O. Box 8138, Philadelphia 1, Pa.

NEW CATALYST

HIGHER GASOLINE OCTANES THROUGH PENTAFINING

You can convert the low-quality n-paraffins (C_5, C_6, C_7) in your gasoline pool to high octanes! Pentafining, the process developed by The Atlantic Refining Company, makes it possible. For full particulars, write today to The Atlantic Refining Company, P. O. Box 8138, Philadelphia 1, Pa.

it's the **CATALYST** that counts

ATLANTIC

A typical Struthers Wells CIRCULATING HEATING SYSTEM serving a major Canadian oil refinery

The Dowtherm heaters shown above are installed in the plant of a major Canadian oil refiner. The heaters are part of Struthers Wells circulating heating systems, utilizing liquid Dowtherm as the heating medium, at temperatures of approximately 700°F.

This equipment is used to supply process heat for reboilers and other heat transfer equipment, as installed in a modern lubricating oil refining operation. This type of equipment insures close temperature control and high heat transfer rates in the users. The capacity of these systems is 60,000,000 BTU per hour, making it one of the largest installations of this type.

Struthers Wells is a major supplier of circulating heating systems for both liquid and vapor service, and utilizing commercial heat transfer fluids in a wide temperature range. Hundreds of successful installations, many of them repeat orders, provide a wide background on which to base recommendations for any type of service.

Fired heaters for the direct heating of process fluids, as gas, steam, and hydrocarbons, to the highest commercial temperature ranges are also built by Struthers Wells.

STRUTHERS WELLS PRODUCTS

PROCESSING EQUIPMENT DIVISION

Crystallizers . . . Direct Fired Heaters . . . Evaporators . . . Heat Exchangers . . . Mixing and Blending Units . . . Quick Opening Doors . . . Special Carbon and Alloy Processing Vessels . . . Synthesis Converters

BOILER DIVISION

BOILERS for Power and Heat . . . High and Low Pressure . . . Water Tube . . . Fire Tube . . . Package Units

FORGE DIVISION

Crankshafts . . . Pressure Vessels . . . Hydraulic Cylinders . . . Shafting . . . Straightening and Back-up Rolls

MACHINERY DIVISION

MACHINERY for Sheet and Structural Metal Forming . . . Tangent Benders . . . Folding Machines . . . Roller Table and Tumble Die Bending Machines . . . Press Brakes . . . Punching and Notching Machines . . . Forming Dies

STRUTHERS WELLS *Corporation*

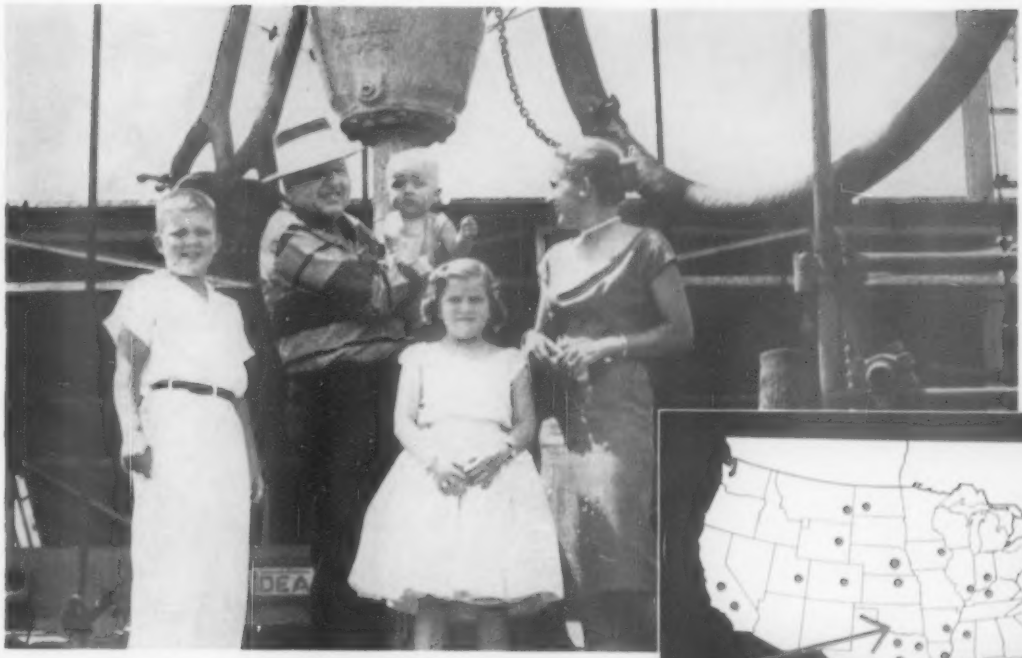
Struthers Wells

WARREN, PA.

Plants at Warren, Pa. and Titusville, Pa.

Offices in Principal Cities

Oil Financing from the **FIRST** *in* **DALLAS**
goes where you go . . .



Mr. and Mrs. Quintin Little and family on site of Harrell Well No. 1, Doyle Field, Stephens County, Oklahoma. An oilman well known to all Independents, Mr. Little is a longtime customer of the FIRST in DALLAS.

Specialized experience, organization, and resources to help you with practically any kind of need for "working money".

FIRST NATIONAL BANK IN DALLAS

Member Federal Deposit Insurance Corporation

put FIRST financing
in your own oil future

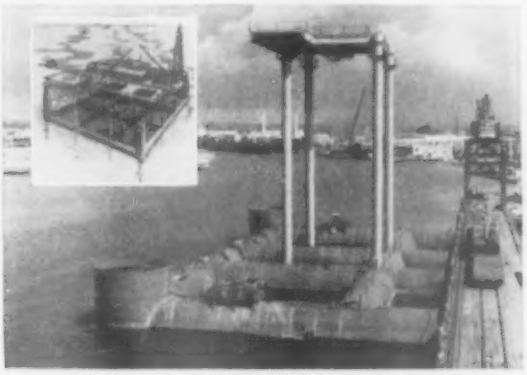
Six Rigs—Four Companies

ALL ELECTRO

—All Diesel-Electric...and -MOTIVE POWERED

We had this aerial view of the yards at Orange, Texas, taken for just one reason. It tells more literally than words how Electro-Motive Power is being accepted in the drilling industry everywhere. In this one photograph, there are six offshore drilling platforms or tenders in various stages of construction for four different concerns. All have one major thing in common: *each is equipped with Electro-Motive Diesel-Electric Power.*

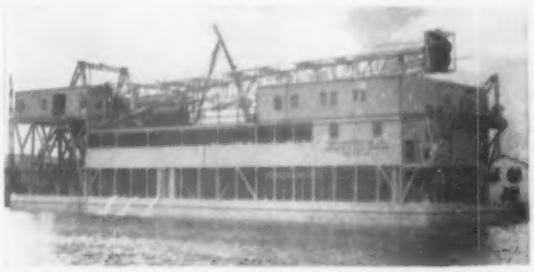
For drilling over land or water it will pay you to investigate the flexibility, control and economy of Electro-Motive Power — the new standard for deep drilling applications. Contact your Electro-Motive representative for complete details.



1 Shown here is Kerr-McGee's Rig No. 47, a mobile type of drilling device under construction by American Bridge Division of U. S. Steel. Three Electro-Motive Power units will be located on the rig, supplying power for mud pumps, drawworks and rotary table. Due for completion late this year, the drilling device brings to three the number of Electro-Motive Powered rigs for Kerr-McGee.

2 Rigs No. 54 and 55 for Offshore Company are shown here nearing completion in the American Bridge yards of U. S. Steel Corp. These mobile drilling barges, each powered by three 875 hp. Electro-Motive Power units, are capable of operating in waters up to 100 feet in depth. Each barge measures 200 feet long and 104 feet wide and contains eight hydraulically operated, 225-foot supporting legs.

3 This tender, one of four being converted for a major oil company, is shown at the Levingston yards at Orange. A former LST, the tender features a heliport and is completely outfitted with modern eating, sleeping and recreation facilities for the crew. Two 12-cylinder Electro-Motive Power units rated at 1200 hp. each will be located in the tenders as the power source for large mud pumps.



4 The Penrod Drilling Company's W. H. (Bill) Dordan, a submersible island drilling barge, powered by 3 Electro-Motive units, is one of two recently christened. Built by Levingston, the Dordan is now drilling for Placid Oil Company. The second Electro-Motive powered barge, the Tom Sorrell, is also completed and drilling for Placid Oil. Both these barges are capable of drilling 18,000 feet in 19 feet of water.

ELECTRO-MOTIVE DIVISION · GENERAL MOTORS

LA GRANGE, ILLINOIS *In Canada:* General Motors Diesel Limited, London, Ontario

Petroleum Industry sales offices: Tulsa, Oklahoma; Houston, Texas; Dallas, Texas; Morgan City, Louisiana; Pasadena, California

J&L Service

wraps up the world's most wanted

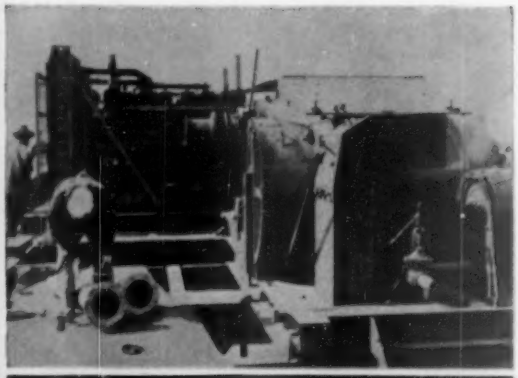
Rotary Rigs

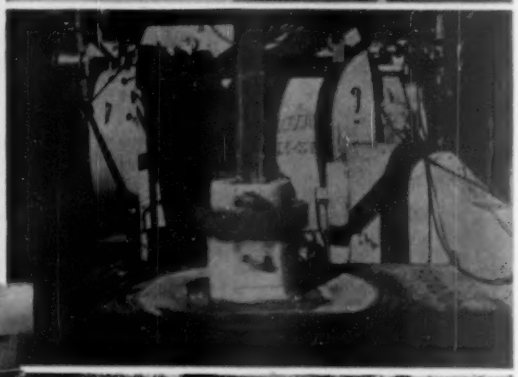
A driller's natural desire to own the last word in equipment has made Ideco the most wanted rotary rigs in the world.

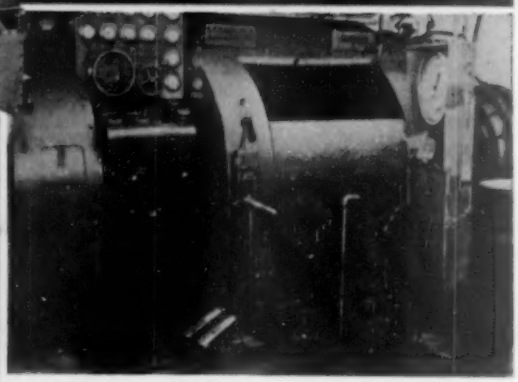
J&L parts service wraps up this situation — makes these finest of all rigs the best buy in the United States and Canada.

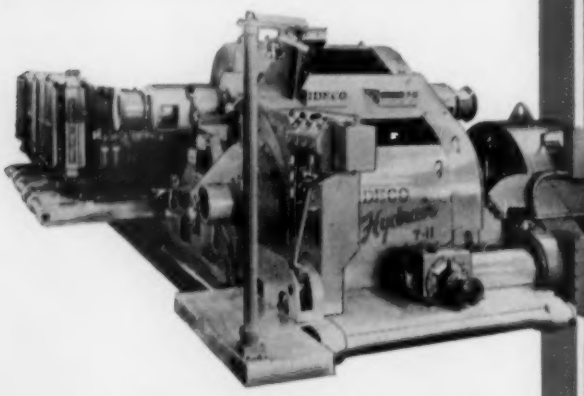
J&L has an Ideco designed and rated to do the job you have in mind and — thanks to J&L service — keep on doing it.

For detailed descriptions, specifications, performance characteristics, get your J&L store on the telephone. Ask for Catalog No. 55.









Rig capacities from 2,500′ to 20,000′ with 4½″ drill pipe. Rigs to 6,000′ capacity can be trailer mounted.

"Hydrair" hoists combine a hydraulic torque converter drive with air clutch and air controls.

Power rigs have a mechanical or fluid-coupling drive, with air clutch and air controls.

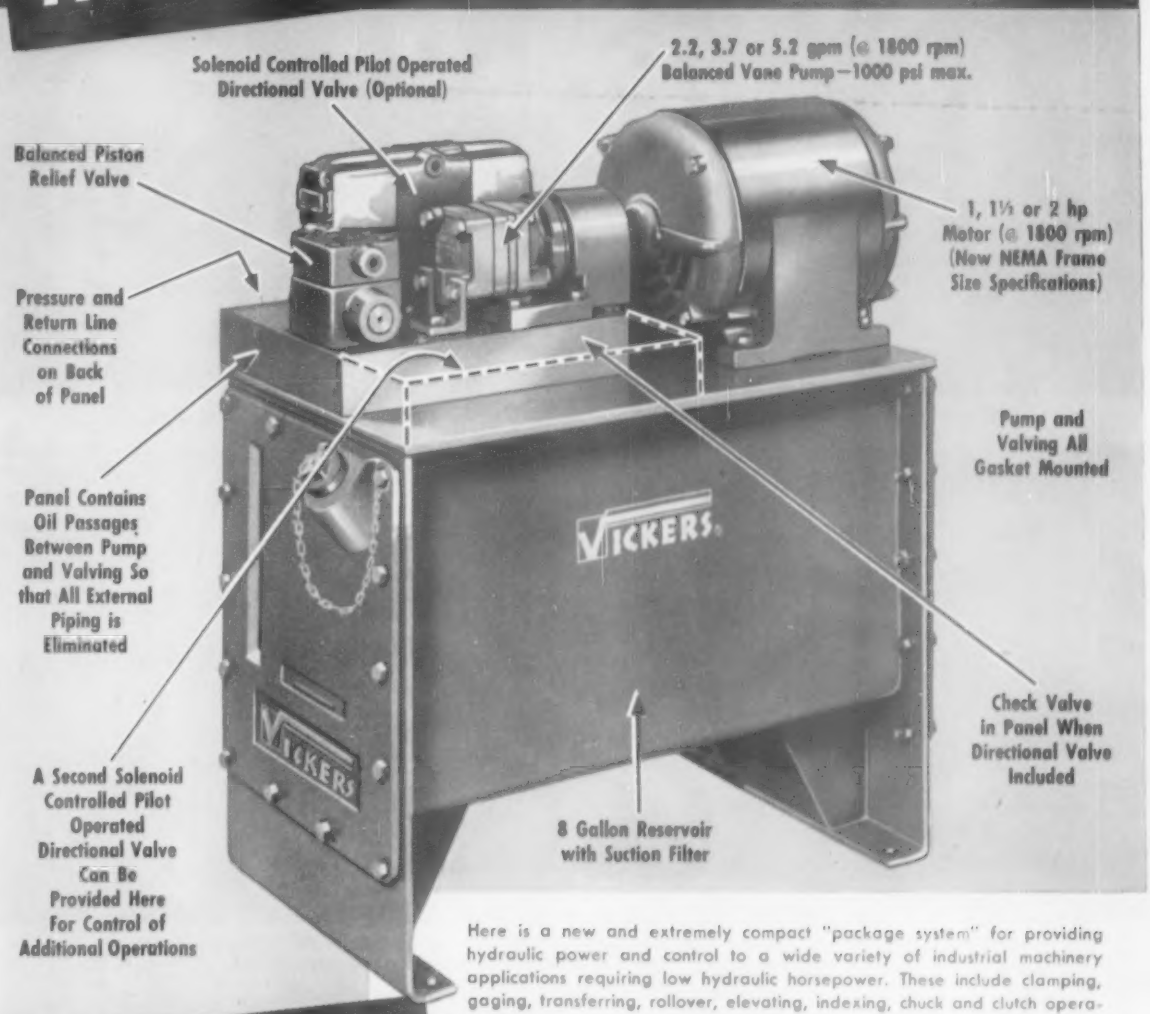
Jones & Laughlin

SUPPLY DIVISION – Tulsa

SERVING THE UNITED STATES AND CANADA

10-M

A NEW IDEA . . . in hydraulic power and control systems


Solenoid Controlled Pilot Operated Directional Valve (Optional)
2.2, 3.7 or 5.2 gpm (@ 1800 rpm) Balanced Vane Pump—1000 psi max.
Balanced Piston Relief Valve
1, 1½ or 2 hp Motor (@ 1800 rpm) (New NEMA Frame Size Specifications)
Pressure and Return Line Connections on Back of Panel
Pump and Valving All Gasket Mounted
Panel Contains Oil Passages Between Pump and Valving So that All External Piping is Eliminated
VICKERS
Check Valve in Panel When Directional Valve Included
A Second Solenoid Controlled Pilot Operated Directional Valve Can Be Provided Here For Control of Additional Operations
8 Gallon Reservoir with Suction Filter

Here is a new and extremely compact "package system" for providing hydraulic power and control to a wide variety of industrial machinery applications requiring low hydraulic horsepower. These include clamping, gaging, transferring, rollover, elevating, indexing, chuck and clutch operations, etc.

Note the many features indicated on the photograph above. The result is improved and simplified hydraulic design . . . also reduced installation and maintenance costs. This "package system" has great flexibility . . . is available in a wide variety of combinations of standard components assembled to suit individual requirements. Pretested and ready for immediate operation, it has also the advantage of undivided Vickers responsibility. For further information, ask for installation drawings 178706-8.

VICKERS Series T8 HYDRAULIC PIPELESS POWER PACKAGE*

7311

VICKERS INCORPORATED
DIVISION OF SPERRY RAND CORPORATION
ADMINISTRATIVE and ENGINEERING CENTER
Department 1448 • Detroit 32, Michigan

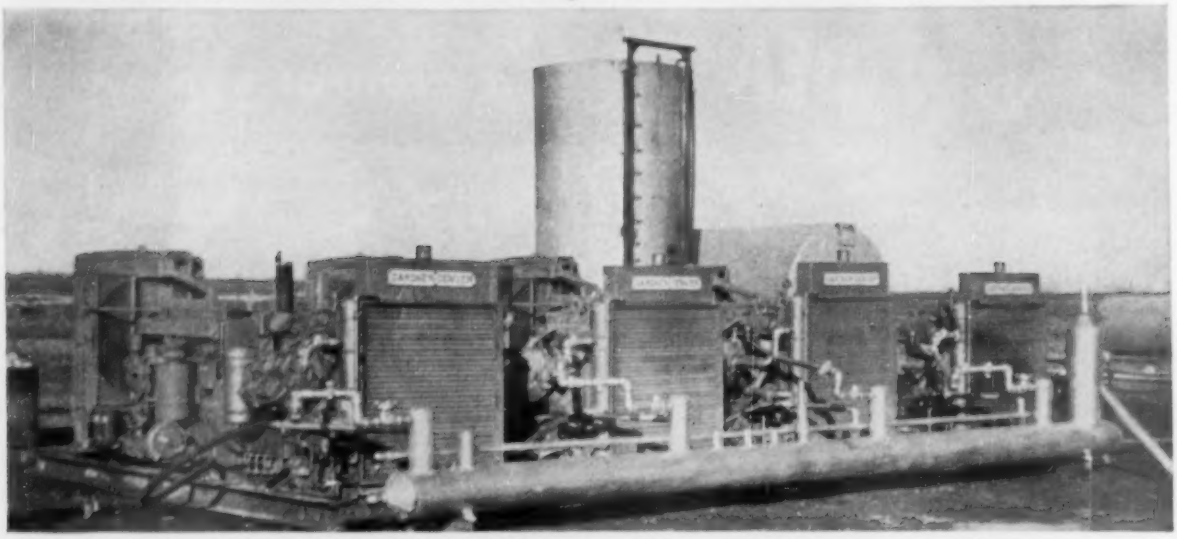
Application Engineering Offices: • ATLANTA • CHICAGO • CINCINNATI CLEVELAND • DETROIT • HOUSTON • LOS ANGELES AREA (El Segundo) MINNEAPOLIS • NEW YORK AREA (Summit, N.J.) • PHILADELPHIA AREA (Media) • PITTSBURGH AREA (Mt. Lebanon) • PORTLAND, ORE. • ROCHESTER ROCKFORD • SAN FRANCISCO AREA (Berkeley) • SEATTLE • ST. LOUIS • TULSA WASHINGTON • WORCESTER

IN CANADA: Vickers-Sperry of Canada, Ltd., Toronto

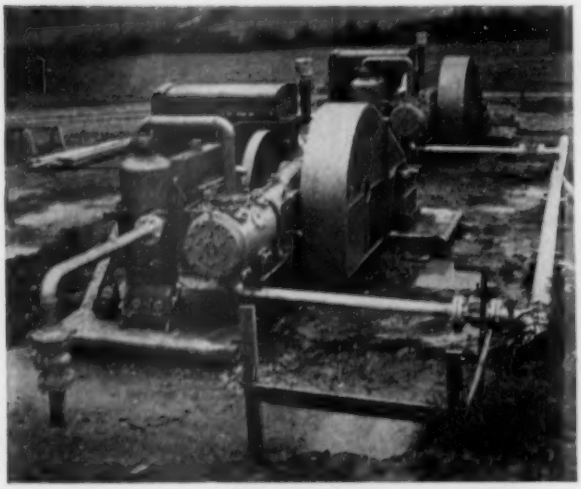
*These "package systems" supplement the Vickers line of standard hydraulic power units.

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

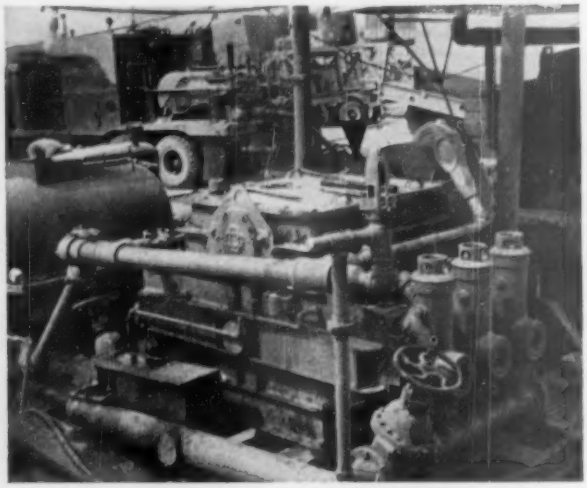
Gardner-Denver... Serving the World's Basic Industries



Four Gardner-Denver Model WEK Compressors skid-mounted with engines for air drilling.



4¾" x 11" Model RX Compressors boosting air pressure for mud aeration.



Gardner-Denver Model PL-7 Triplex Plunger Pump works on mud aeration job.

In air drilling and mud aeration

GARDNER-DENVER FITS ALL JOBS

There are Gardner-Denver quality pumps and compressors designed to handle any air drilling or mud aeration job. Call your nearest Gardner-Denver representative for details. Gardner-Denver service specialists are on call in: Houston, Corpus Christi, Odessa, Wichita Falls, New Orleans, Shreveport, Oklahoma City, Ellinwood, Casper, Edmonton, Tulsa, Pittsburgh and Los Angeles.

GARDNER - DENVER

THE QUALITY LEADER IN COMPRESSORS, PUMPS, ROCK DRILLS AND AIR TOOLS FOR CONSTRUCTION, MINING, PETROLEUM AND GENERAL INDUSTRY

Gardner-Denver Company, Quincy, Illinois — Gardner-Denver Export Division, 233 Broadway, New York 7, N. Y.
In Canada: Gardner-Denver Company (Canada), Ltd., Winnipeg—Edmonton—Toronto
Oilfield Offices:
Dallas, Houston, Tulsa, St. Louis, Los Angeles, New York, Pittsburgh, Denver, New Orleans, San Francisco, Kansas City

Gardner-Denver . . . the only mud pump with these money-saving features!

BRONZE BEARINGS

A Gardner-Denver exclusive!

The eccentric bushings, connecting rod bearings and crosshead pin bushings . . . all bronze bearings with forced feed lubrication . . . cushions the heavy, reciprocating loads.

DIVIDED FLUID CYLINDER

Another Gardner-Denver exclusive!

Gardner-Denver fluid ends are divided so that either half can be replaced independently of the other. The cylinder halves are identical and fit either right or left side.

CONTINENTAL SUPPLY COMPANY

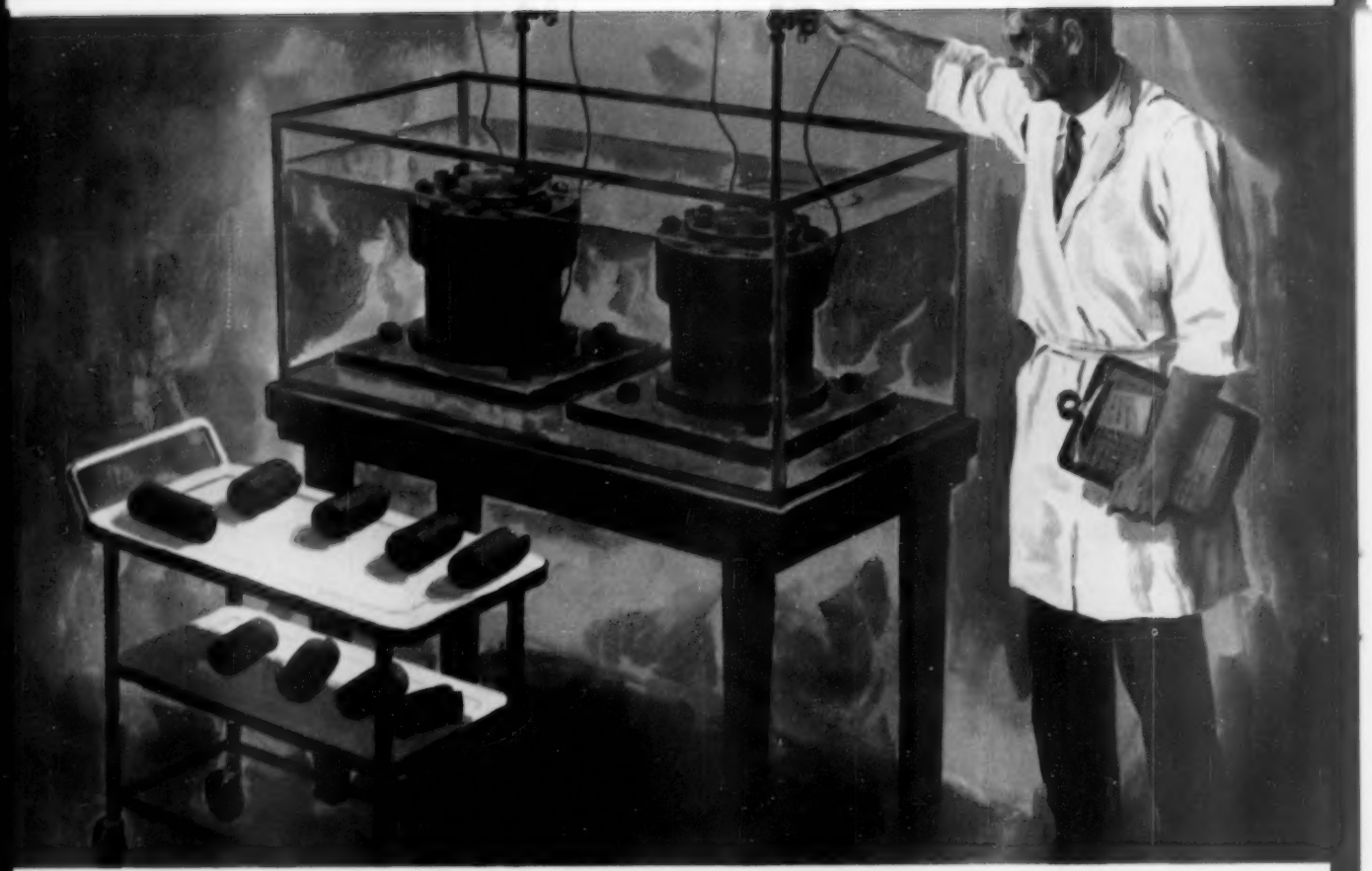
A Division of The Youngstown Sheet and Tube Company

General Offices: DALLAS, TEXAS

Representatives in All Principal Oil Fields of the World

CONTINENTAL

Serving the Oil and Gas Industries



Heat and oxygen applied under extreme pressure accelerate aging in "Oxygen-Bomb" test.

New York Belting & Packing Company's constant research and development results in consistently superior rubber products

The "O-Bomb" Aging Test is one of many laboratory tests conducted by New York Belting & Packing Company. It and the "grab-pull" test are typical of the continuous research and development carried on to assure that they provide you with the best rubber products that can be produced.

Continental Supply Company stocks

a complete line of New York

Belting & Packing Company

oil field rubber products.

NEW YORK BELTING & PACKING CO. • Founded 1846

CONTINENTAL

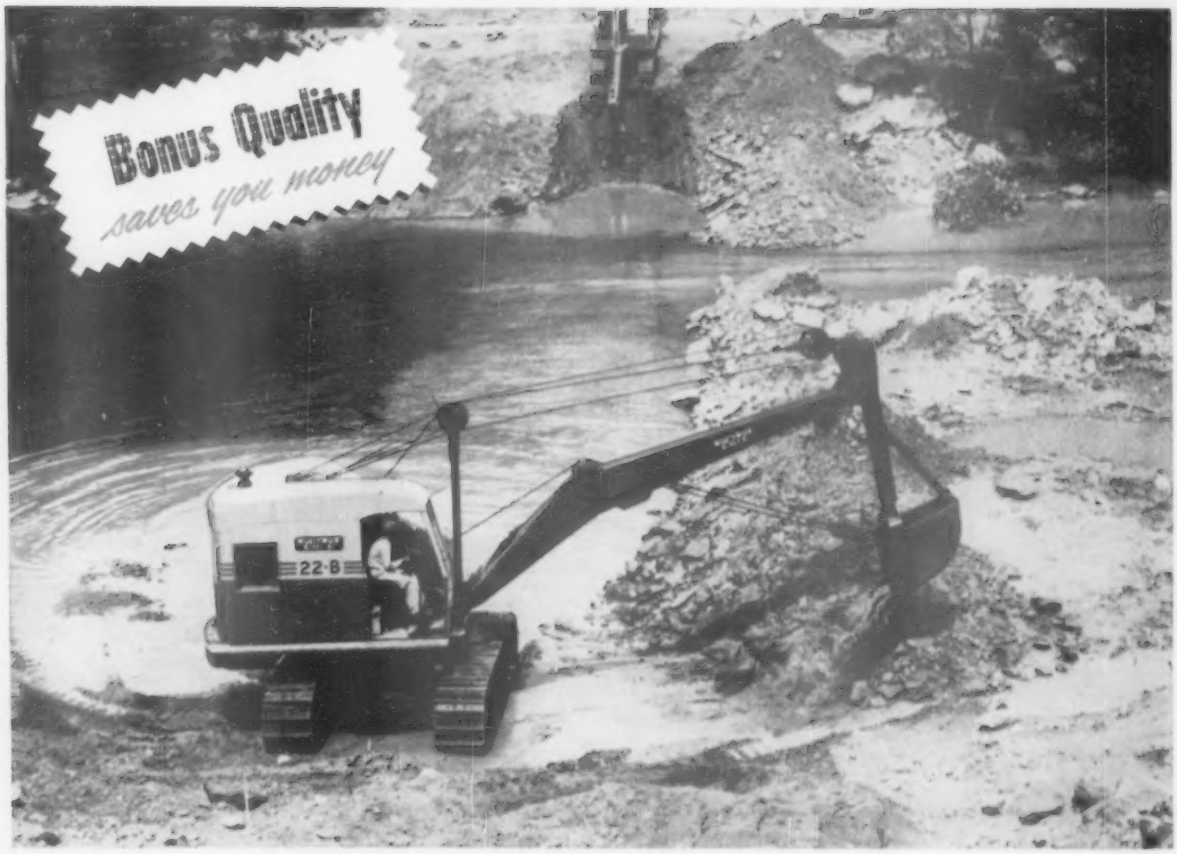
Serving the Oil and Gas Industries

CONTINENTAL SUPPLY COMPANY

A Division of The Youngstown Sheet and Tube Company

General Offices: DALLAS, TEXAS

Representatives in All Principal Oil Fields of the World



Help your spreads stay on schedule...

EQUIP THEM WITH DEPENDABLE, FAST-DIGGING BUCYRUS-ERIE DRAGSHOVELS

When you put sure-footed, high-output Bucyrus-Erie 15-B and 22-B dragshovels in the hands of experienced pipeliners, you've got a combination that's *geared to move on schedule.*

For the greater mobility needed by pipeliners, special mounting with tractor-type crawlers having deep grousers is available for these machines at extra cost. It provides the traction and mobility to cover rough terrain, enables these machines to climb grades up to 35 per cent, and to maneuver through swamps and mud. Clearance is high, too, for easy travel over rocks and obstacles — up to 16½ in. for the 15-B, and 20¾ in. for the 22-B.

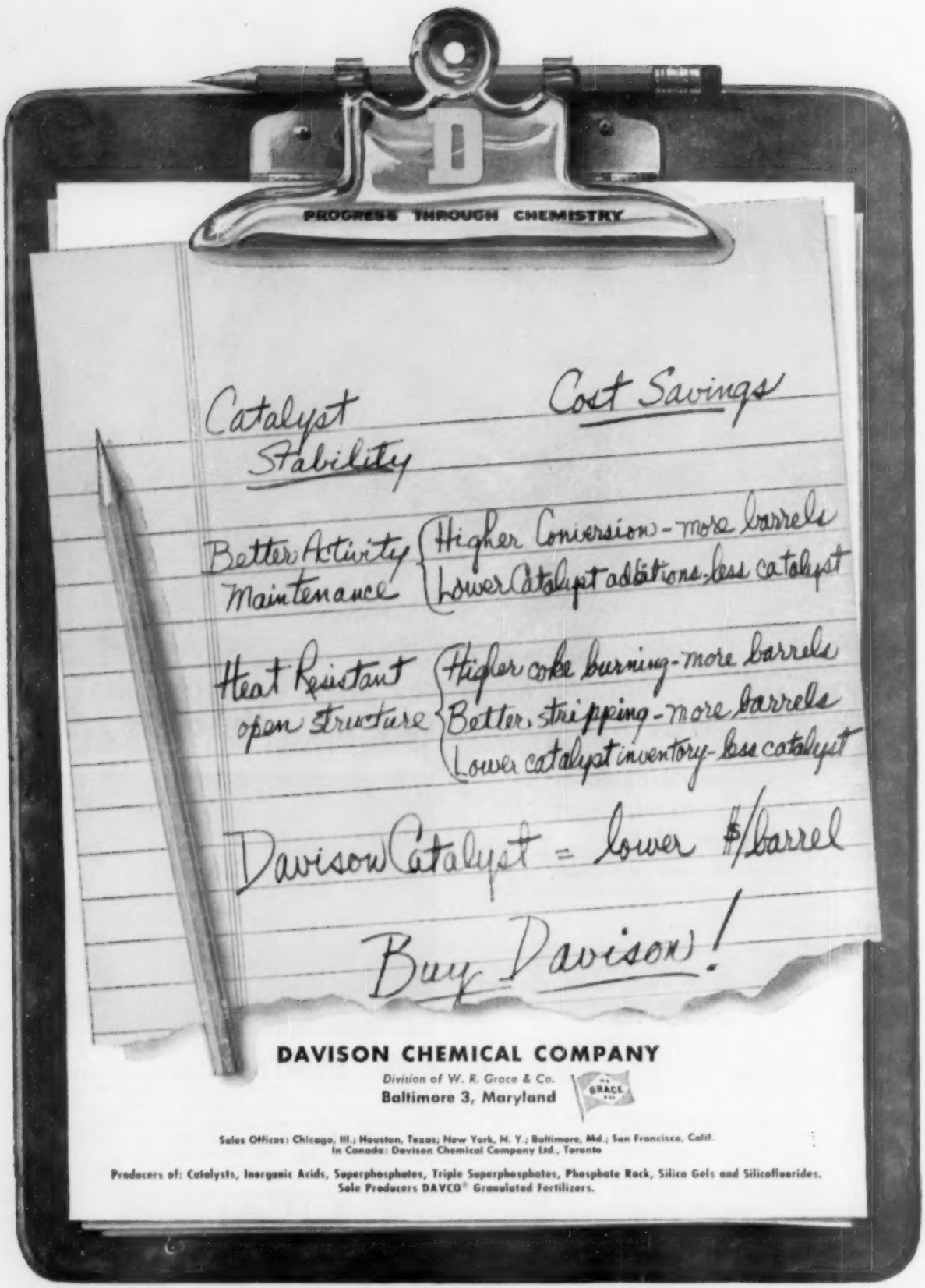
A powerful digging stroke plus rapid hoist and swing produce consistently high output even in hard digging. Just as important is Bucyrus-Erie's traditionally sound and proved design that insures maximum working time and keeps maintenance to a minimum.

Your nearby Bucyrus-Erie distributor will give you the complete story on the dragshovels that experienced pipeliners depend on — the ½-yd. 15-B and ¾-yd. 22-B. See him soon. 237E56

Bonus Quality Bucyrus-Erie leaves nothing to chance. This sample pouring from a furnace will be tested to insure that it measures up to the highest specifications. This testing is done with *all* steel used by Bucyrus-Erie — your assurance of the Bonus Quality that means money saved day after day, year after year.

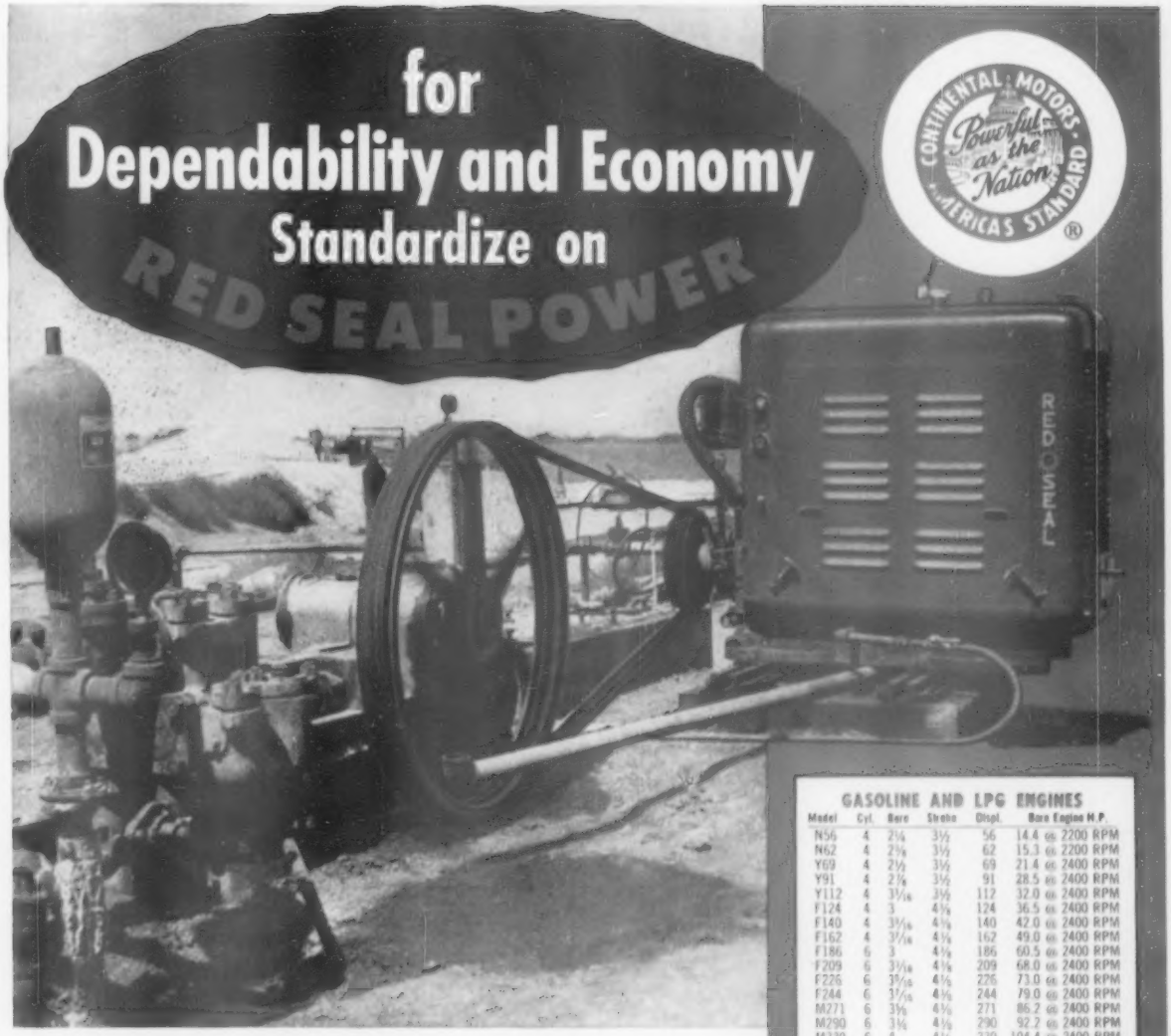
BUCYRUS ERIE

SOUTH MILWAUKEE, WISCONSIN


D
PROGRESS THROUGH CHEMISTRY
Catalyst Stability
Cost Savings
Better Activity Maintenance
Higher Conversion - more barrels
Lower Catalyst additions - less catalyst
Heat Resistant open structure
Higher coke burning - more barrels
Better stripping - more barrels
Lower catalyst inventory - less catalyst
Davison Catalyst = lower ¢/barrel
Buy Davison!
DAVISON CHEMICAL COMPANY
Division of W. R. Grace & Co.
Baltimore 3, Maryland
GRACE
Sales Offices: Chicago, Ill.; Houston, Texas; New York, N. Y.; Baltimore, Md.; San Francisco, Calif.
In Canada: Davison Chemical Company Ltd., Toronto
Producers of: Catalysts, Inorganic Acids, Superphosphates, Triple Superphosphates, Phosphate Rock, Silica Gels and Silicofluorides.
Sole Producers DAVCO® Granulated Fertilizers.

for Dependability and Economy Standardize on RED SEAL POWER

CONTINENTAL MOTORS · Powerful as the Nation · AMERICA'S STANDARD ®



The petroleum industry's widening use of Red Seal engines traces mainly to two factors. One is the broad diversification of the Red Seal line—more than 100 basic models, from 14 h.p. to 1,000-plus*, for use on all standard fuels . . . The other is Continental's long standing reputation for dependability—their inbuilt capacity to deliver more power, longer, at lower cost. Ask for them at your supply store.

GASOLINE AND LPG ENGINES

Model	Cyl.	Bore	Stroke	Displ.	Bare Engine H.P.
N56	4	2¼	3½	56	14.4 @ 2200 RPM
N62	4	2⅜	3½	62	15.3 @ 2200 RPM
Y69	4	2½	3½	69	21.4 @ 2400 RPM
Y91	4	2⅞	3½	91	28.5 @ 2400 RPM
Y112	4	3 1/16	3½	112	32.0 @ 2400 RPM
F124	4	3	4½	124	36.5 @ 2400 RPM
F140	4	3 1/16	4½	140	42.0 @ 2400 RPM
F162	4	3 1/16	4½	162	49.0 @ 2400 RPM
F186	6	3	4½	186	60.5 @ 2400 RPM
F209	6	3 1/16	4½	209	68.0 @ 2400 RPM
F226	6	3 5/16	4½	226	73.0 @ 2400 RPM
F244	6	3 1/16	4½	244	79.0 @ 2400 RPM
M271	6	3⅜	4½	271	86.2 @ 2400 RPM
M290	6	3⅛	4½	290	92.2 @ 2400 RPM
M330	6	4	4½	330	104.4 @ 2400 RPM
M363	6	4	4 11/16	363	128.9 @ 2800 RPM
B371	6	4⅛	4⅝	371	110.0 @ 2400 RPM
B427	6	4 5/16	4⅞	427	127.0 @ 2400 RPM
G134	4	3½	4½	134	34.2 @ 2000 RPM
G157	4	3⅝	4½	157	40.0 @ 2000 RPM
E201	4	3⅞	4⅞	201	65.4 @ 2400 RPM
H227	4	3⅝	5½	227	54.0 @ 1800 RPM
H243	4	3¼	5½	243	57.9 @ 1800 RPM
H260	4	3⅜	5½	260	62.0 @ 1800 RPM
H277	4	4	5½	277	66.4 @ 1800 RPM
K363	6	4	4 11/16	363	123.0 @ 2400 RPM
J382	4	4½	6	382	74.0 @ 1400 RPM
T371	6	4⅛	4⅝	371	119.0 @ 2400 RPM
T427	6	4 5/16	4⅞	427	140.0 @ 2400 RPM
U501	6	4½	5¼	501	159.0 @ 2400 RPM
R513	6	4½	5½	513	164.3 @ 2400 RPM
R572	6	4¼	5¼	572	182.4 @ 2400 RPM
R602	6	4⅓	5½	602	191.7 @ 2400 RPM
V603	8	4½	4½	603	220.0 @ 2800 RPM
S749	6	5½	5½	749	217.0 @ 2200 RPM
S820	6	5¼	5½	820	237.0 @ 2200 RPM

CUSHIONED POWER DIESEL ENGINES

Model	Cyl.	Bore	Stroke	Displ.	Bare Engine H.P.
ZD129	4	3¼	3⅞	129	34.0 @ 2000 RPM
GD157	4	3½	4½	157	39.0 @ 2000 RPM
*ED201	4	3⅝	4⅞	201	45.8 @ 2000 RPM
HD243	4	3⅛	5½	243	55.0 @ 2000 RPM
*HD260	4	3⅜	5½	260	59.0 @ 2000 RPM
*HD277	4	4	5½	277	63.2 @ 2200 RPM
*JD382	4	4½	6	382	72.5 @ 1600 RPM
TD427	6	4 5/16	4⅞	427	106.0 @ 2000 RPM
RD572	6	4¼	5½	572	154.0 @ 2000 RPM
VD603	8	4½	4½	603	175.0 @ 2600 RPM
SD802	6	5 5/16	5½	802	202.0 @ 1800 RPM

*Available for industrial applications only.

*High-output air-cooled military models developed jointly by Army Ordnance and Continental are now available for commercial applications where high output (375 to 1,000-plus h.p.) low weight, and exceptional compactness are required. For information, address Continental Motors Corporation, Military Division, 76 North Getty Street, Muskegon, Michigan.

1955 WINNER NATIONAL SAFETY COUNCIL PUBLIC INTEREST Award

PARTS AND SERVICE EVERYWHERE

Continental Motors Corporation

MUSKEGON • MICHIGAN

[illegible] SPRINGS ROAD [illegible] 3817 SOUTH SANTA FE AVENUE, LOS ANGELES
[illegible] OAKLEIGH DR. [illegible] GEORGIA

For effective, long-term protection against corrosion . . .

Close-up of Transhield Asbestos Pipe Line Felt, showing parallel-spaced glass yarns.

Coating and wrapping pipe line to check corrosion and assure long-term service.

. . . use Johns-Manville TRANSHIELD® ASBESTOS PIPE LINE FELT

Johns-Manville Transhield is an economical pipe line felt assuring effective, long-term protection against corrosion under average soil conditions.

Designed for easy, high-speed application by modern machine methods, Transhield is strong and highly tear-resistant. Its light weight permits its use in 800-ft. rolls. This advantage cuts roll changes in half for field wrapping equipment.

Transhield provides a protective membrane of coal-tar saturated asbestos felt, reinforced with continuous glass yarns parallel-spaced on ¼" centers. It cannot rot or decay, thus acts as an enduring barrier to shield pipe line enamels from earth loads and soil stress.

For severe soil conditions use Johns-Manville #15 Asbestos Pipe Line felt . . . proven in service for over 30 years.

For further information about Transhield, write to Johns-Manville, Box 14, New York 16, N. Y. In Canada, 565 Lakeshore Road East, Port Credit, Ont.

JM PRODUCTS

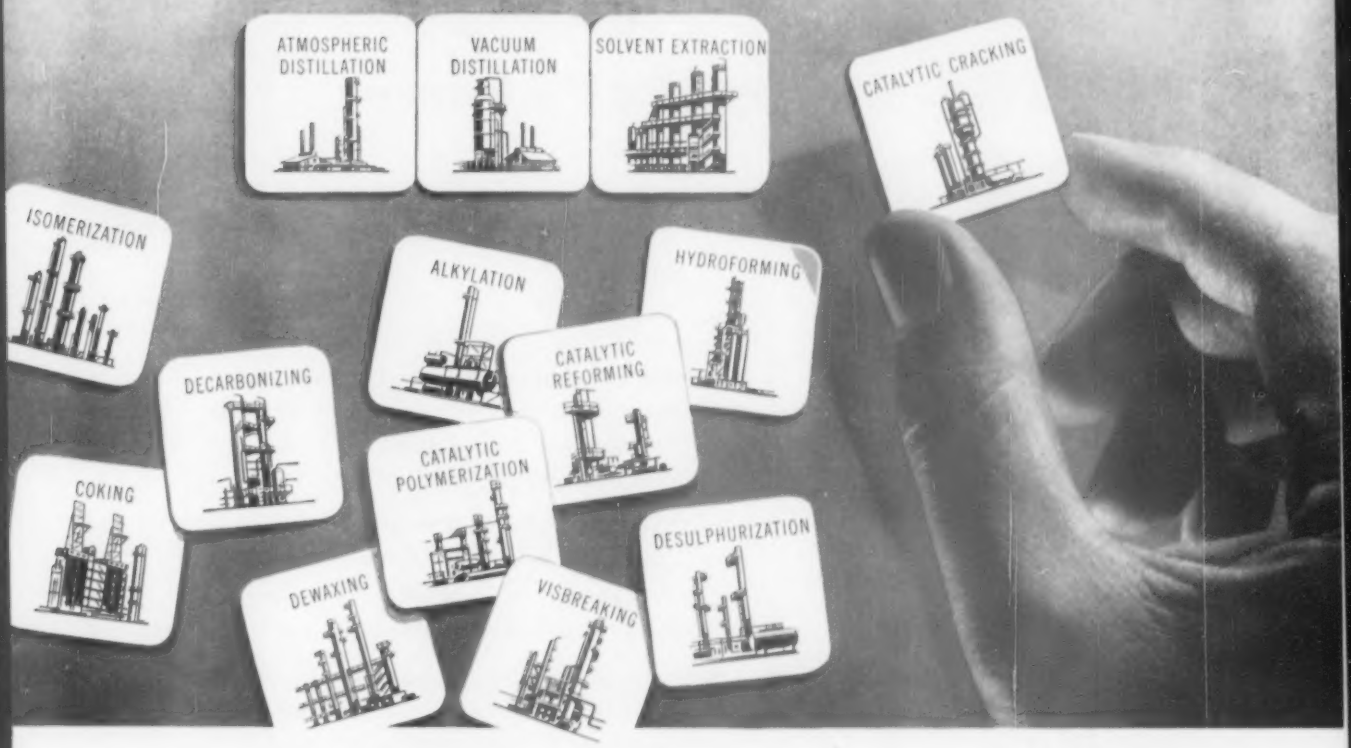
Johns-Manville PRODUCTS FOR PIPE LINE PROTECTION

$3 Billion Contest for Oil Refiners

How many or how few process units go to make up a winning petroleum refinery? How should they be arranged, and in what size, to form an integrated yet flexible whole? How fast can they be put together? And how well will the combination stand up against future competition, changing fuel demands, and technical obsolescence? To find the answers, oil companies today are planning to spend an estimated $3,000,000,000 on refining facilities within the next three years.

As the world's leading engineers and builders of petroleum refineries, The M. W. Kellogg Company is in a unique position to help oil companies work out the right answers. But the best place to begin is in the earliest planning stages—even before inquiry specifications are prepared.

If your company is in the $3 billion contest, we welcome the opportunity to help frame your refining problem and to assume complete responsibility for facilities—from process sequences through design, procurement, and construction, to an early on-stream date.



REFINERY PROCESS DIVISION

THE M. W. KELLOGG COMPANY

711 THIRD AVENUE, NEW YORK 17, N. Y.

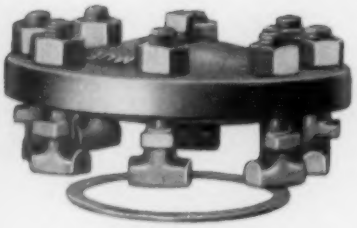
A SUBSIDIARY OF PULLMAN INCORPORATED

The Canadian Kellogg Company Limited, Toronto • Kellogg International Corporation, London
Companhia Kellogg Brasileira, Rio de Janeiro • Compania Kellogg de Venezuela, Caracas
Kellogg Pan American Corporation, New York • Societe Kellogg, Paris

M KELLOGG W

MUELLER®

tie in lines under pressure



H-17505 flanged tee.
Sizes—3", 4", 6", 8".

NO-BLO

The Mueller Flanged Tee lets you make tie-ins to any steel line under pressure. Tee is of forged steel construction with similar analysis to line pipe —assures good weldability. Series 15, 30, 40 or 60 flanges meet all pressure requirements.

After making tap, internal threaded completion plug is inserted into top of tee through gate valve to provide positive seal against leakage. Flanged completion cap provides double seal.

Completion plug incorporates pressure equalizing valve to balance pressure above and below the plus—assures easy insertion and extraction.

Write for step by step installation instructions on the Mueller Flanged Tee. You'll see how you can make tie-ins under pressure safely, without loss of fluid.

MUELLER CO.

Dependable Since 1857

MAIN OFFICE & FACTORY DECATUR, ILLINOIS

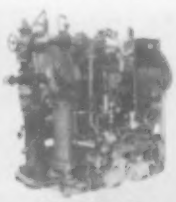
● Manufacturing ●● Manufacturing and product development ●●● Manufacturing, product development and research □●●● Pilot manufacturing, product development and research

I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	GPE CAPACITIES
●●●	●●	●●	□●●●	●●	●●●		●●	●●●	●●	●●	●●	●●●	Precision Mechanics, Optical Devices, Ceramics
●●●	●	●			●●●		●●●	●●	●	●●	●	●●●	Electrical Equipment and Components
●●●	●●	●●●	●●●		●●●		●	●●		●●●	●●	●●●	Electronics
	●●			●●●		●●●				●●●			Hydraulics, Liquids Processing, Heat Exchange
●	●		●●●		●					●			Television: Studio, Theatre, Business, Institutional, Industrial
●●●	●	●●	□●●		●●●	●●●	●●	●●		●●●	●	●●●	Instruments, Servos, Controls: Hydraulic, Pneumatic, Magnetic, Electronic
●●●	●		●●●		●●●		●			●●	●	●●●	Aircraft and Missile Guidance, Control, Simulation
●●●	●	●	□●●		●●●					●●●		●●●	Automatic Computers and Components
●●●	●	●●	●●●		●●			●		●			Radar, Microwave, Ultrasonics
	●●●		□●●				●●	●●●	●●●		●●●		Motion Picture and Audio Equipment
●●●				●●						●●		●●●	Nuclear Power Components and Controls
●●●			●●●	●●●	●●●	●●●				●●●		●●●	SYSTEMS ENGINEERING

Librascope Desk-Size Computer

Link Aviation F-890 Jet Simulator

GPL Industrial-Institutional TV System



Griscom-Russell Shipboard Distilling Plant

Askania Electro-Jet Power Package

GPE SYSTEMS ENGINEERING

The GPE Companies are leaders in that small, select group in American industry which is broadly qualified to develop and produce the systems needed today for defense and industry. GPE leadership accounts for some of the most advanced systems in use in business, television, aviation, marine, steel, oil, and other industrial fields.

In Systems Engineering, highly advanced capacities and resources are prerequisite. Yet, no matter how highly advanced, they are of little use if limited to a few areas. Finding optimum solutions to complex systems problems calls for *balanced competences*. And beyond that, success calls for the consistent application of such competences *at every stage* — beginning with research, and extending all the way through development, production and final testing.

No GPE company is limited by the boundaries of its own specialties. The basic GPE operating policy, GPE Coordinated Precision Technology, places at the command of each company in the group all GPE research, development and production facilities, and the skills and experience of the more than 2500 GPE technical men working in depth in the wide range of advanced capacities indicated in the chart above.

Behind each group working on a specific problem in one GPE company stands the whole group of GPE scientists, engineers and technicians with the answers — or the knowledge that will find the answers — to questions underlying and related to that problem. To the customers of GPE Companies this means that the concept and development of equipment, components and systems are not restricted or distorted by traditional allegiance to specific competences.

The five systems illustrated, while products of different GPE companies, are all examples of the consistent application of balanced competences, achieved through GPE coordination. For brochure describing GPE Coordinated Precision Technology and the work of the GPE Companies, or help on a specific problem, write: General Precision Equipment Corporation, 92 Gold Street, New York 38, N. Y.

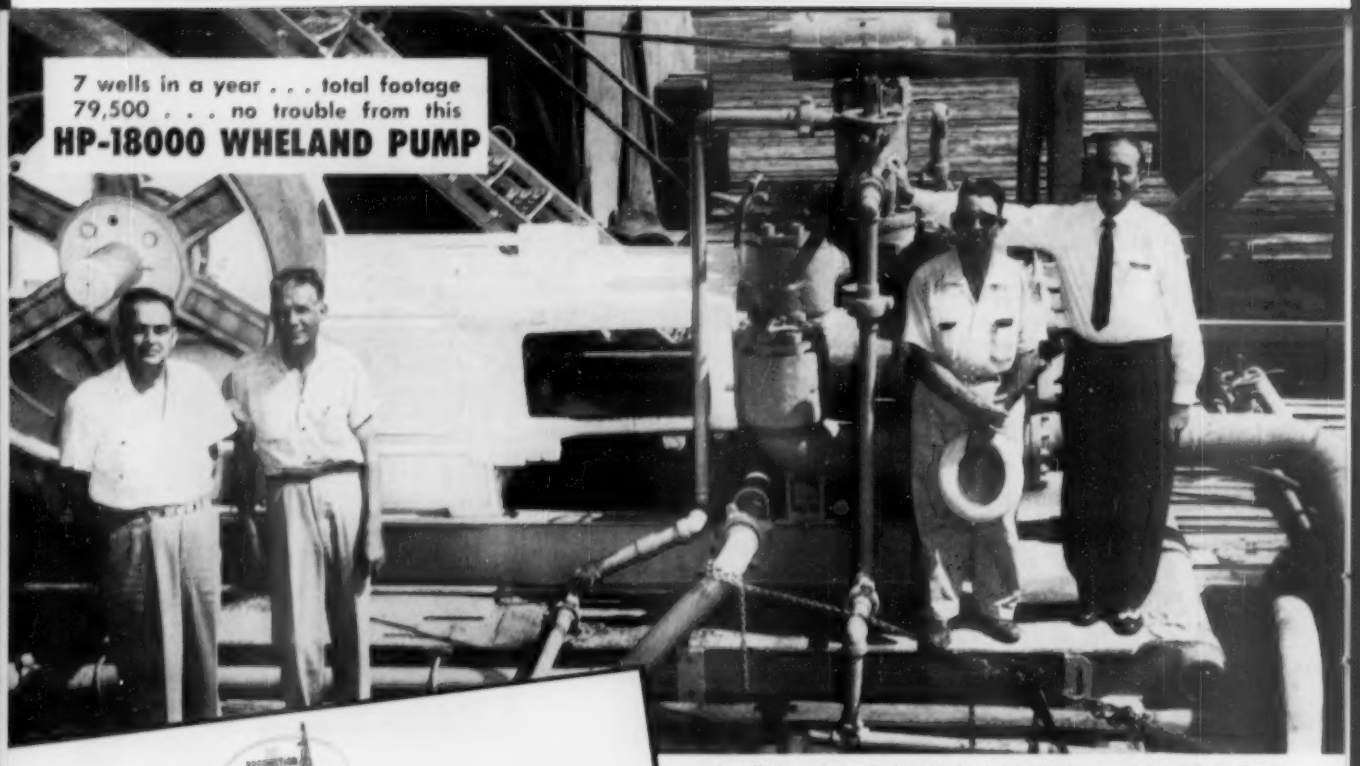
GENERAL PRECISION EQUIPMENT CORPORATION

THE GPE PRODUCING COMPANIES

(I) KEARFOTT COMPANY, INC. (II) INTERNATIONAL PROJECTOR CORPORATION (III) BLUDWORTH MARINE
(IV) GENERAL PRECISION LABORATORY INCORPORATED (V) THE GRISCOM-RUSSELL COMPANY (VI) LINK AVIATION, INC.
(VII) SHAND AND JURS CO. (VIII) THE HERTNER ELECTRIC COMPANY (IX) THE STRONG ELECTRIC CORPORATION
(X) J. E. McAULEY MFG. CO. (XI) ASKANIA REGULATOR COMPANY (XII) AMPRO CORPORATION (XIII) LIBRASCOPE, INCORPORATED

7 wells in a year . . . total footage 79,500 . . . no trouble from this

HP-18000 WHELAND PUMP



Installation view of the Wheland HP-18000 owned by Oil Production Maintenance, Inc., Houston, Texas. Left to right: Messrs. J. K. Butler, President; Tracy East, Wheland Serviceman; "Pop" Woods, Tool Pusher; Harris Lodge, Homco Salesman.

OIL PRODUCTION MAINTENANCE, INC.

1440 CHOCOLATE BAYOU ROAD — P. O. BOX 14291

HOUSTON 21, TEXAS

September 13, 1956

Mr. Gordon P. Street, President
The Wheland Company
Chattanooga, Tennessee

Dear Mr. Street:

Oil Production Maintenance, Inc. owns and operates two Wheland power pumps. One is a HP-14000 Wheland and the other is a HP-18000. Both of these pumps have been in operation approximately twelve months. We have experienced no difficulty either with the power end or the fluid end of either of these pumps over this period of time. Both of these pumps have been operated within approximately ten per cent of their rated capacities for the full twelve months.

During the twelve months period, the rig which operates the HP-18000 Wheland has drilled seven wells. They have varied in depth from 10,500 feet to 15,000 feet. The total footage accumulated by this rig during this time has been approximately 79,500 feet. We hope, and have every reason for our belief, that the pumps will continue their efficient operation for several years to come.

Yours very truly,

OIL PRODUCTION MAINTENANCE, INC.

J. K. Butler

J. K. Butler, President.

JKB:ml

OWNS 2 WHELAND PUMPS here's the report!

DEPENDABLE OPERATION!

". . . every reason for our belief that the pumps will continue their efficient operation for several years to come."

HP-18000 7¾" x 18", 750 HP Nominal Input at 60 RPM. Discharge Pressure with 7¾" liner 1322 PSI; with 5½" liner, 2700 PSI.

HP-14000 7½" x 14", 350 HP Nominal Input at 60 RPM. Discharge Pressure with 7½" liner 838 PSI; with 5½" liner, 1627 PSI.

BULLETINS ON REQUEST

WHELAND ROTARY DRILLING MACHINERY

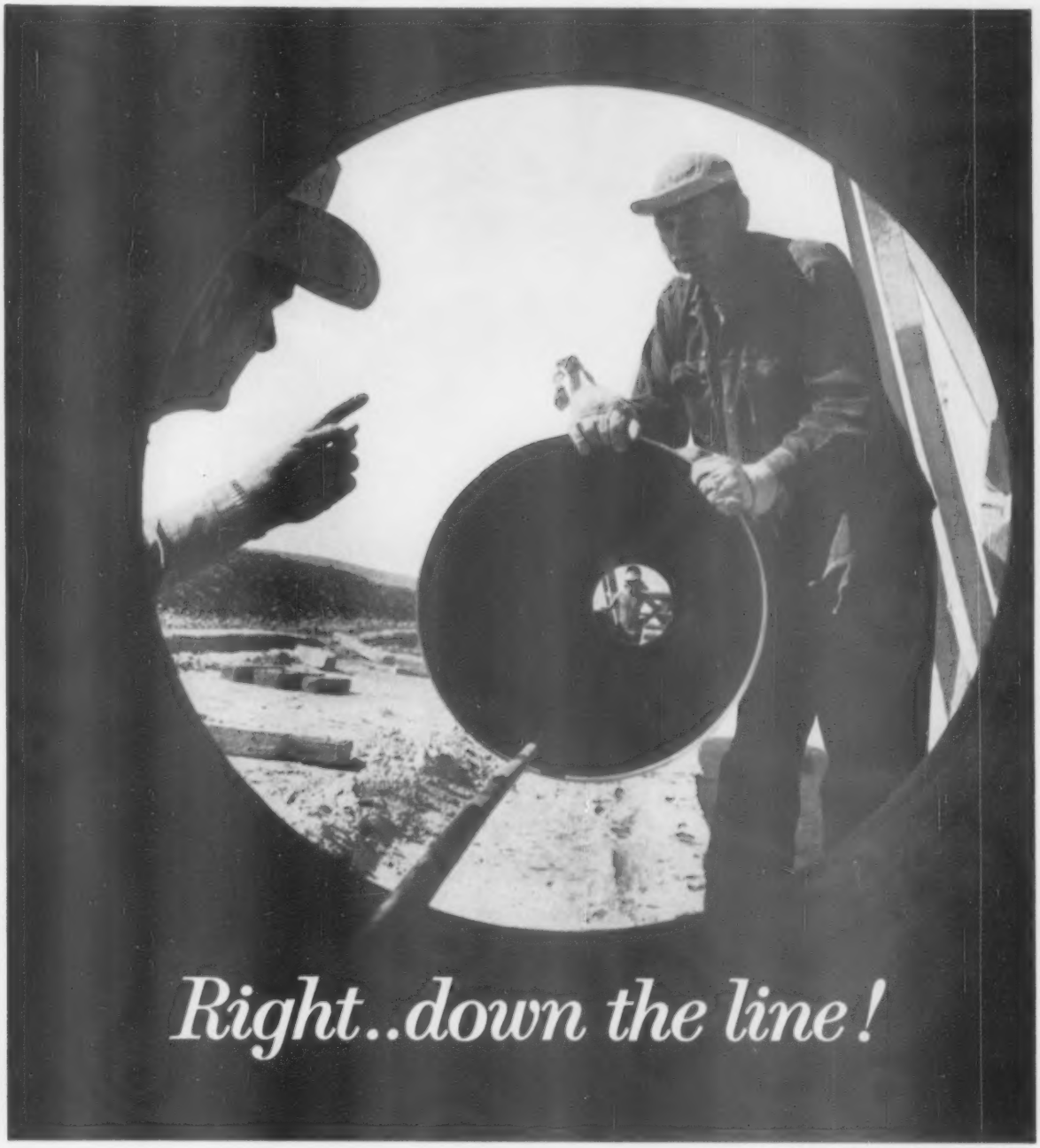
THE WHELAND COMPANY

CHATTANOOGA, TENNESSEE, U.S.A.

DRAW WORKS • SLUSH PUMPS • ROTARIES
CROWN BLOCKS • TRAVELING BLOCKS • SWIVELS

DOMESTIC DISTRIBUTORS: INDUSTRIAL SUPPLY COMPANY, INC.—Main Office: Wichita Falls, Texas • HOUSTON OIL FIELD MATERIAL COMPANY, INC.—Main Office: Houston, Texas • JONES AND LAUGHLIN STEEL CORPORATION, SUPPLY DIVISION—Main Office: Drawer 2481, Tulsa 2, Oklahoma.

EXPORT DISTRIBUTORS: LUCEY EXPORT CORPORATION—233 Broadway, New York 7, New York—Broad Street House, London, E. C. 2, England.



PACIFIC NORTHWEST PIPELINE CORPORATION PHOTOGRAPH.

Quality, uniformity, precision—these are watchwords that you can always depend on when you use Kaiser Steel Line Pipe.

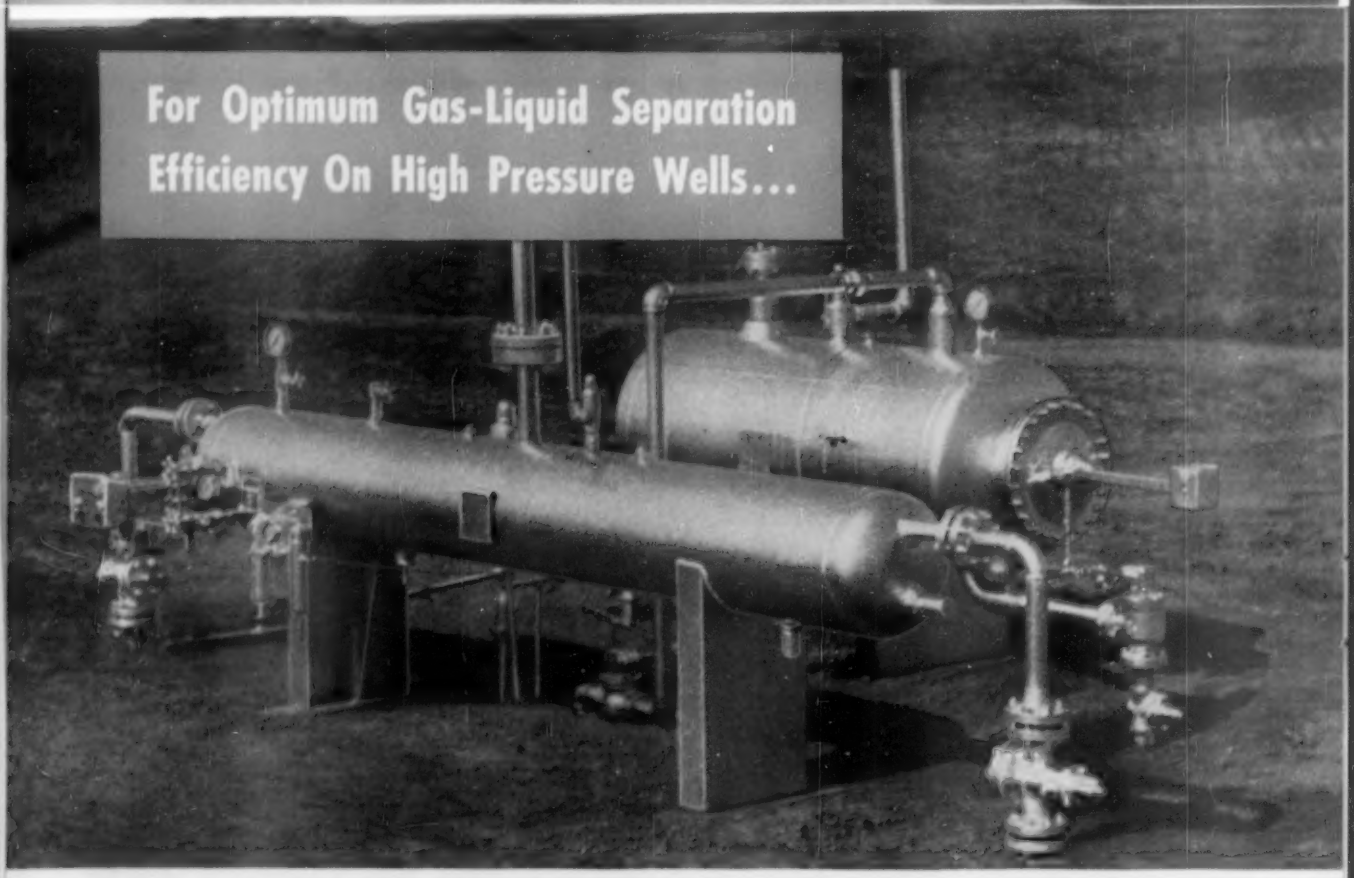
For example, Kaiser Steel Line Pipe—20 inch OD and larger—is placed in restraining dies and expanded by water under great pressure. This hydraulic expansion assures accurate diameter, concentricity and straightness—and also strengthens the pipe through additional cold working. Another example of the painstaking care that goes into the manufacture of pipe from Kaiser Steel.

Next time you are ordering line pipe, specify Kaiser Steel Line Pipe. Rely on Kaiser Steel quality and service to add dollars to your operating profits.

Kaiser Steel

Steel Mill Products: plates • hot rolled strip and sheet • cold rolled strip and sheet • tin plate • continuous weld pipe • electric weld pipe • alloy and carbon bars • bar shapes • structural shapes semi-finished steels • pig iron • ingot molds • coke by-products • **Fabricating Division:** steel fabrication for construction, aircraft, missile and other industries • expanded fusion weld pipe reinforced concrete pipe • tanks • For specifications, write: **KAISER STEEL CORPORATION** • **Los Angeles** • **Oakland** • **Seattle** • **Portland** • **Phoenix** • **Denver** • **Tulsa** • **New York**

CROWN BLOCKS • TRAVELING BLOCKS • SWIVELS England.



Specify

The BS&B Model DC Separator!

Because of its exclusive internal design incorporating a large gas-liquid separation chamber, a large liquid collecting and surge chamber, and a highly efficient mist extraction section all within its single horizontal cylinder, the Model DC Separator gives optimum separation efficiency on high pressure wellstreams.

Take the installation pictured above, for example. This Model DC Separator (foreground) is teamed up with a Model H Low Pressure Separator to form a two-stage hookup for processing the condensate-laden gas produced on a Kansas lease.

High gravity distillate is removed from the wellstream by the Model DC at approximately 60° F., and is then transferred to the Model H for further stabilization of the light ends at a reduced pressure of approximately 110 psi. Sales gas goes to the gathering line at 1000 psi, and condensate to the stock tanks at a pressure of 16 oz.

If you have a gas-liquid primary separation problem, why not get the facts on the Model DC from your BS&B Representative? Or you may write to . . .

MODEL DC SEPARATORS FEATURE...

- ✓ High Separation Efficiencies
- ✓ Proven BS&B Controls
- ✓ Easy Serviceability
- ✓ "In-Line" Hookup
- ✓ Excellent Cold Weather Operating Characteristics
- ✓ Wide Selection of Shell Sizes
- ✓ Working Pressures from 500 to 7500 psi.

OVER 60 YEARS
BS&B
ANOTHER EXAMPLE OF PRODUCT LEADERSHIP

BLACK, SIVALLS & BRYSON, INC.

Oil & Gas Equipment Div., Dept. 1-A118
P. O. Box 1714 Oklahoma City, Oklahoma

gas has come a long way...

50 years ago . . . a yellow haze in the streets.

Today, natural gas is a 14 billion dollar industry . . .
the nation's sixth largest. Serving 100 million people . . .
over a hundred thousand industrial plants.
Supplying one quarter of the nation's heat and energy.
Made possible by pipeline transportation.

Tennessee Gas, the nation's longest pipeline,
brings nature's finest fuel from the gas-producing
Southwest to the densely populated East.

Hauls it safely, cheaply, dependably . . . 2200 miles across
15 states . . . a long way to serve America.

Today natural gas, shipped by long distance pipeline to millions of homes, enables modern gas appliances to provide easier, healthier living throughout America.

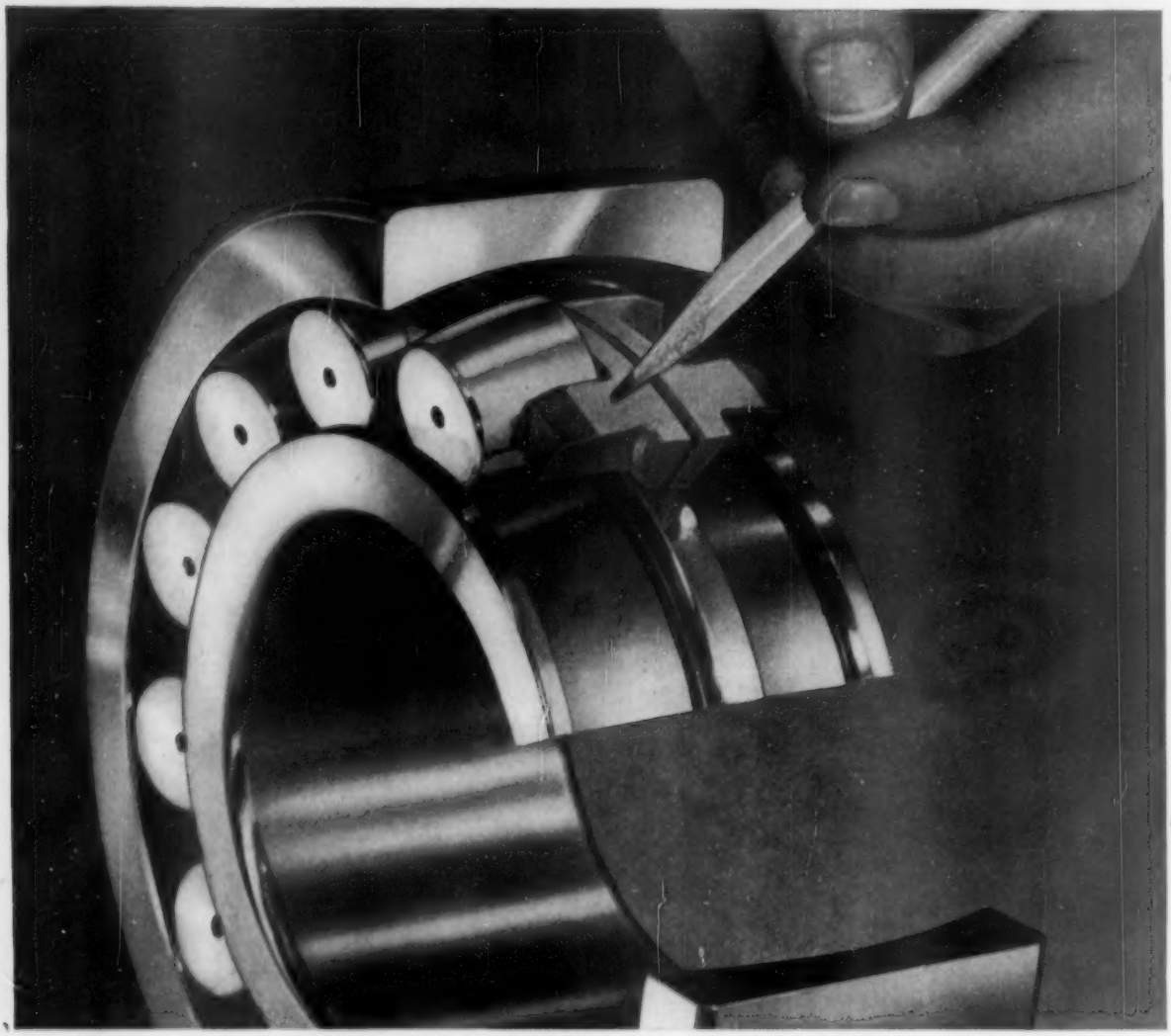
TENNESSEE GAS
TRANSMISSION COMPANY
AMERICA'S LEADING TRANSPORTER OF NATURAL GAS
HOUSTON, TEXAS

One of a series of advertisements appearing in full color in national publications.

And keeps going places . . . Advertisements like this tell the public about the constantly expanding service provided by the natural gas industry . . . point out the great strides made in assuring adequate supplies and the modern convenience of gas to millions.

TENNESSEE GAS TRANSMISSION COMPANY
HOUSTON, TEXAS

TORRINGTON *SPHERICAL ROLLER* BEARINGS



Land-riding cages for longer life!

These fully machined cast-bronze, land-riding cages—one for each path of rollers—are important performance builders in TORRINGTON's Spherical Roller Bearings. The one-piece retainers keep the rollers perfectly aligned at all times, even under conditions of shock load and sustained speeds. Lubrication is more effective, too, as the lubricant has easy access to vital points of contact between rollers and races.

This feature is typical of TORRINGTON'S design, made possible through long experience in serving industry with the finest in precision bearings. That's why it pays to look to TORRINGTON first when your application calls for Spherical Roller Bearings. They're available from stock with either straight or tapered bore, for shaft or adapter mounting.

THE TORRINGTON COMPANY
South Bend 21, Ind. • Torrington, Conn.
District offices and distributors in principal cities of United States and Canada

90th ANNIVERSARY 1865-1955

TORRINGTON BEARINGS

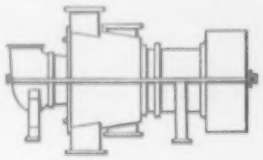
Spherical Roller • Tapered Roller • Cylindrical Roller
Needle • Ball • Needle Rollers

Westinghouse 5000-hp gas turbine

gives you the reliability you want

The mechanical simplicity and conservative design of Westinghouse turbines give you the reliability you expect and want in pipeline service. • The complete absence of sliding motion reduces friction and wear to an absolute minimum. • There is no cooling water system required. • Permanent alignment is assured by turbine's rigid construction — no bedplate is needed. • The highly precise hydraulic governing system has been proved on millions of horsepower of steam turbines.

For more information, see your Westinghouse sales engineer, or write for booklet DB-1515 to Westinghouse Electric Corporation, 3 Gateway Center, Pittsburgh 30, Pa. J-50590

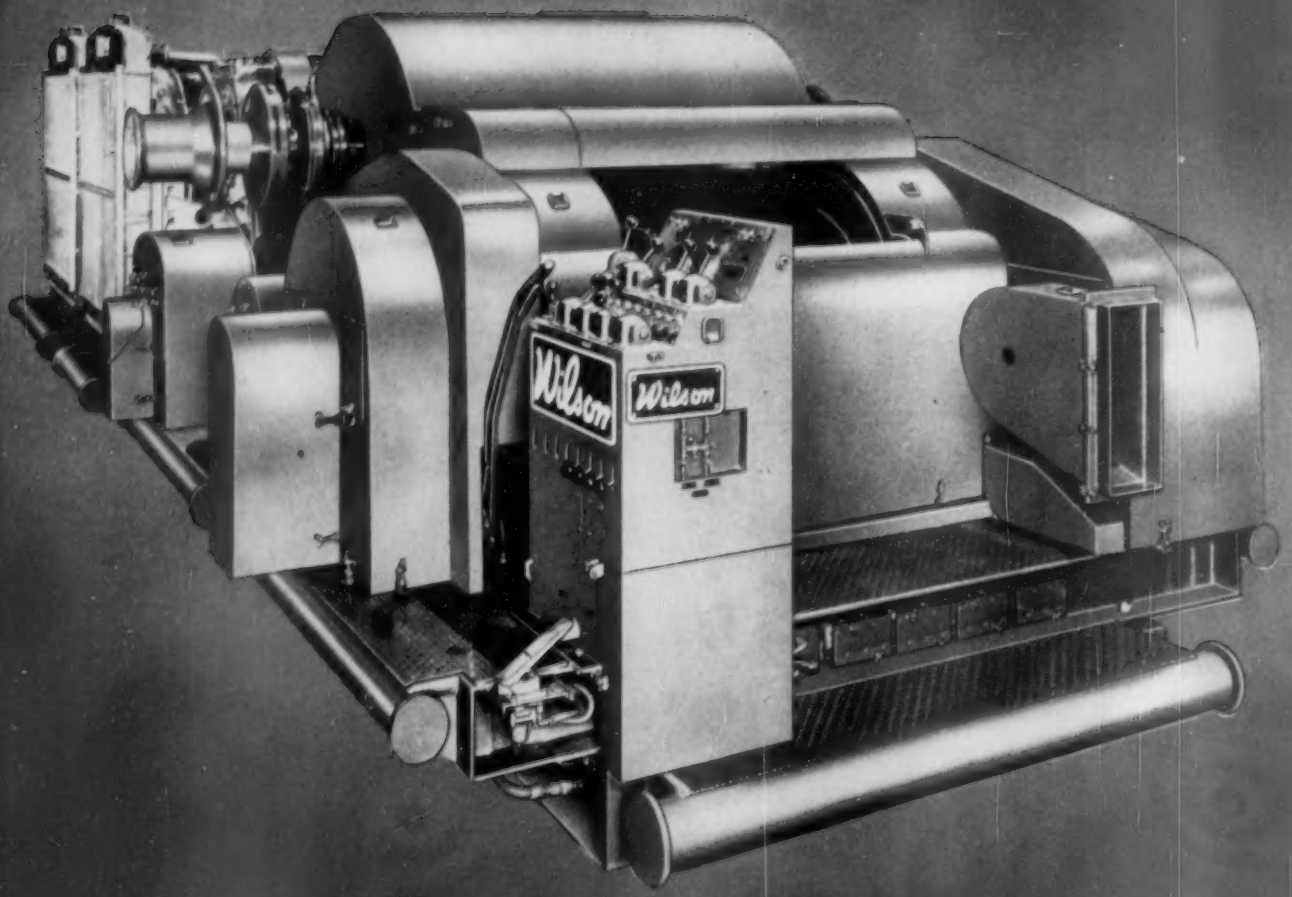


WATCH WESTINGHOUSE!

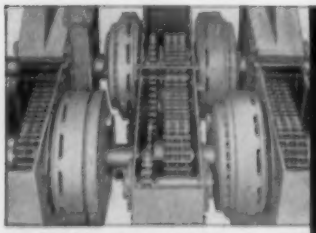
WHERE BIG THINGS ARE HAPPENING FOR YOU!

5000-hp gas turbine with cover removed.

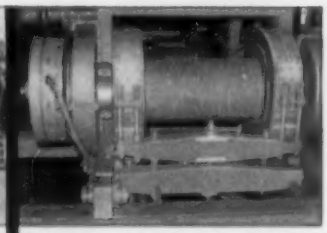
SUPER GIANT RIG



be modern - buy Wilson



- With New Three Speed and Reverse All Friction Clutch Transmission
- Available with Parkersburg 22" Single Hydromatic Brake Mounted on Transmission with 6 Speeds Between Drum and Brake—The Best Hydromatic Brake Arrangement Yet Devised!



- With New Beam Equalizer, Single Nut Adjustment Lever Type Brake which CANNOT KICK
- Oil Bath Drum Drive Chains Outside Frame
- High and Low Clutches on End of Drum Shaft
- Heavy Plate Chain Cases and Covers

Unquestionably...the most advanced and modern rig in the world today

You owe it to yourself to investigate this new and modern rig before buying

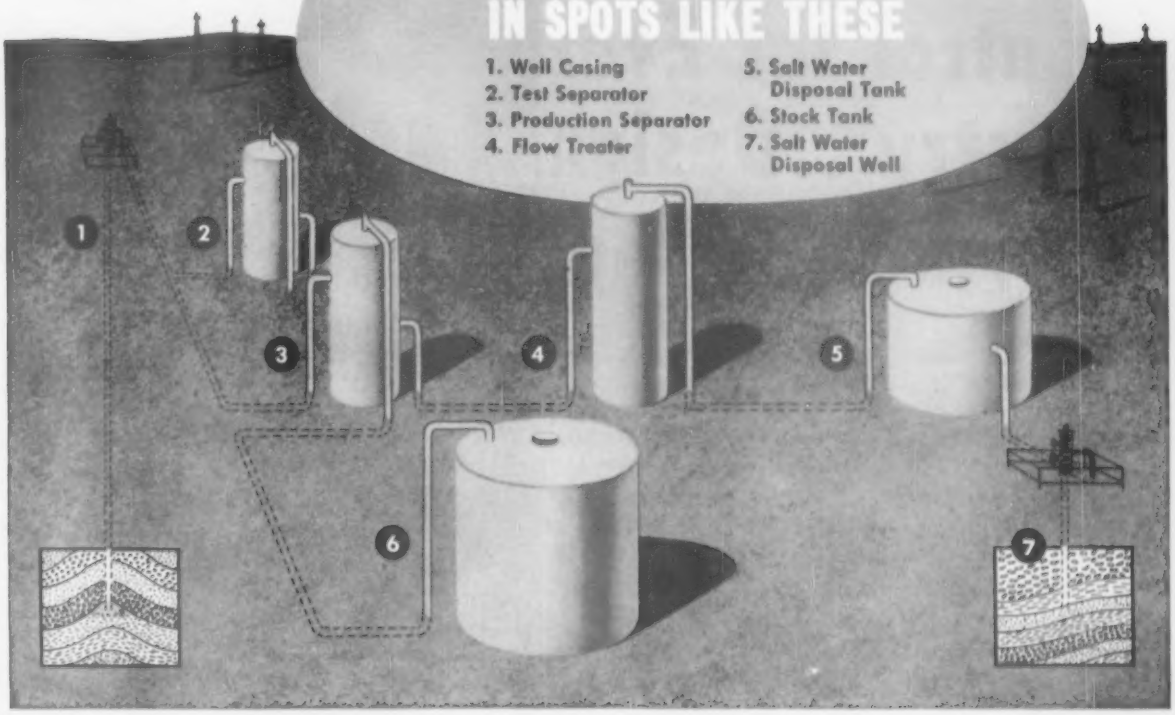
WILSON MANUFACTURING CO., INC.

Wichita Falls, Texas

the home of **RED IRON**

HOW TO PREVENT *Crude Oil Corrosion*

IN SPOTS LIKE THESE



...WITH TARSET®

HERE'S an important new weapon for controlling costly crude oil corrosion. It's TARSET—the effective new *coal tar-epoxy resin* coating. In test after test, Tarset has proved that it can stop corrosion caused by sour crude in storage tanks and in a growing number of other pieces of crude oil handling equipment.

Tarset is the toughest, hardest coating of its kind ever produced from coal tar. It will not shatter at −30°F. or soften at 400°F. It is superior to all other coal tar coatings in its ability to adhere to metal and concrete. And Tarset is easy to apply by brush, roller or spray.

If you have a corrosion problem—above ground or below—call on *Pittsburgh*. Without obligation, our engineers will gladly tackle your specific crude oil corrosion problem . . . and come up with dollar-saving answers. Let us hear from you today.

Send for Descriptive Booklet on TARSET today

Free booklet tells how to use amazing new Tarset to reduce costly corrosion. Gives detailed description of Tarset's specifications, properties and application characteristics. Write for *your* copy today!

COAL CHEMICALS • PROTECTIVE COATINGS • PLASTICIZERS • ACTIVATED CARBON • COKE • CEMENT • PIG IRON

Arrangement Yet Devised!

• Heavy Plate Chain Cases and Covers

Control Problems?...Consult CONTROL EXPERTS

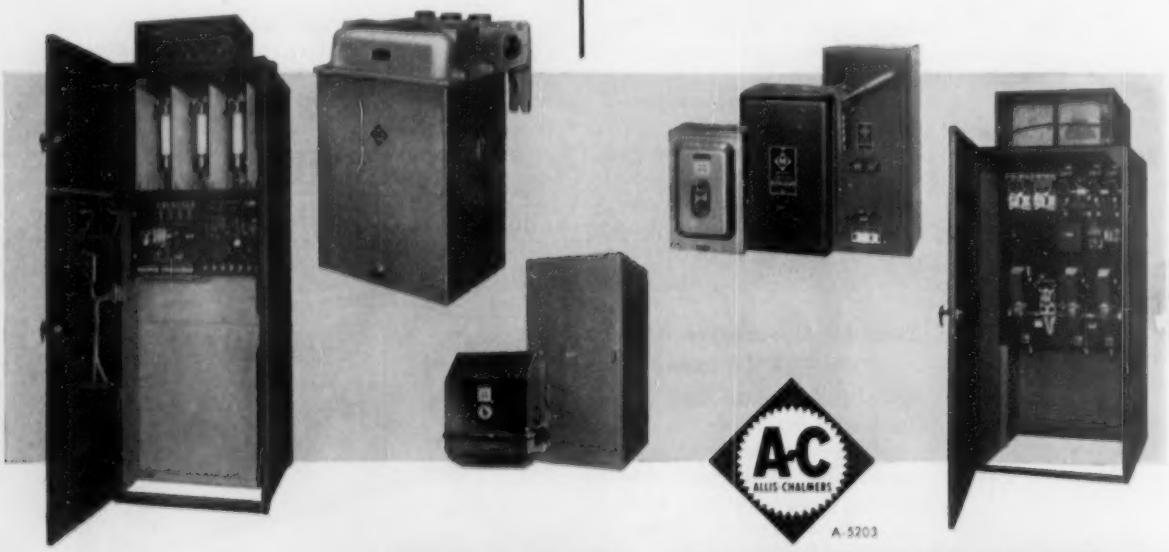
Control for Every Industry...Designed by Allis-Chalmers

THE world's largest line of major industrial equipment is produced by Allis-Chalmers. In supplying equipment to all industries, Allis-Chalmers has been called upon to provide every conceivable type of control . . . STANDARD, MODIFIED and SPECIAL DESIGN . . . in thousands of applications. This experience can help solve any or all of your control problems . . . when you specify *Allis-Chalmers Control.*

For Expert Help With Your Control Problems . . . call your Allis-Chalmers representative. His recommendations are backed by Allis-Chalmers specialized engineering staffs . . . by complete research and testing facilities.

For further information call your nearby A-C office, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

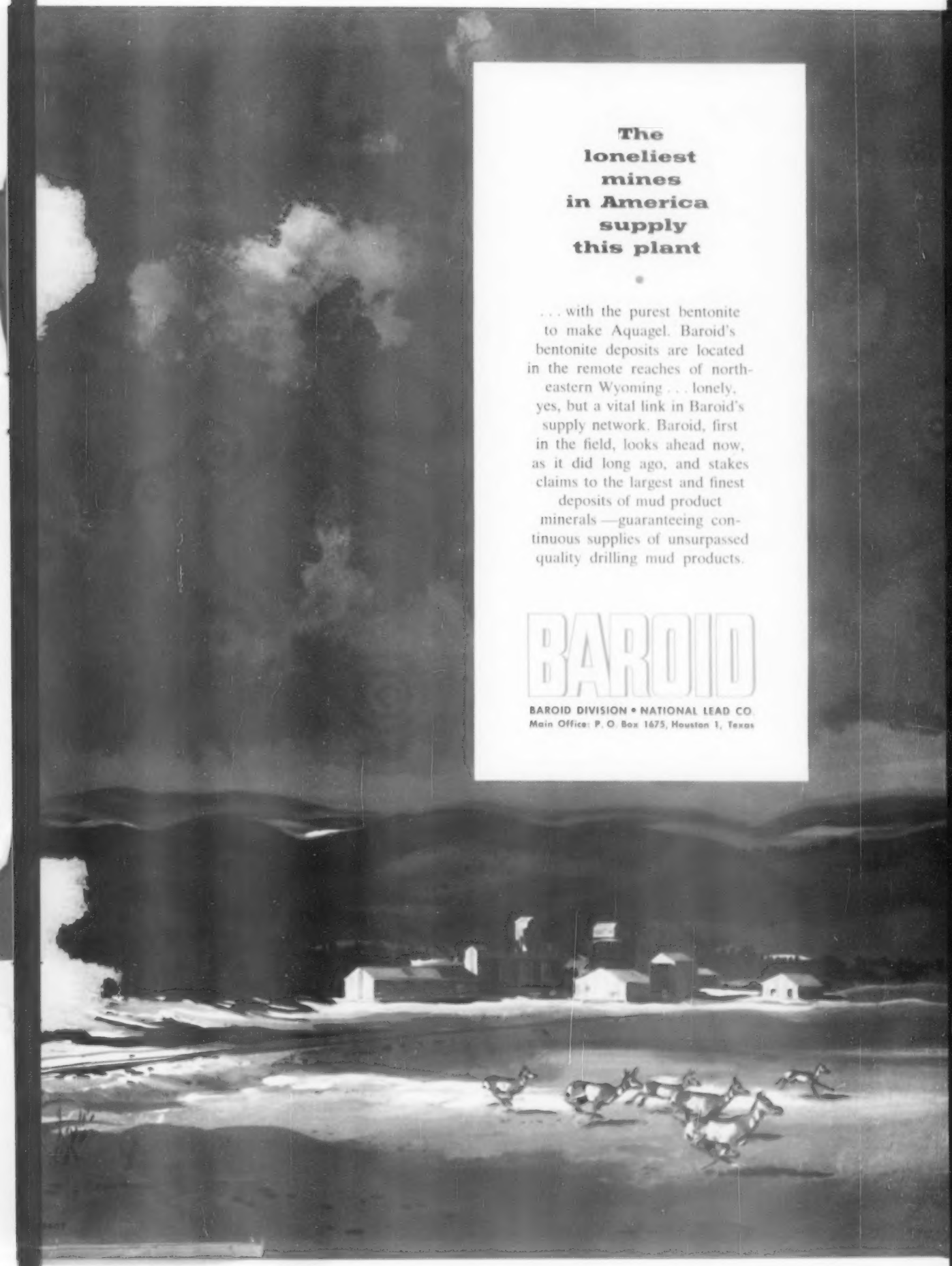
- Utilities
- Textiles
- Stone and Clay
- Rubber
- Petroleum
- Paper
- Mining
- Metal Producing
- Metal Fabricating
- Machinery
- Lumber
- Food Processing
- Chemicals
- Cement
- Automotive



A-C ALLIS-CHALMERS

A-5203

ALLIS-CHALMERS



The loneliest mines in America supply this plant

. . . with the purest bentonite to make Aquagel. Baroid's bentonite deposits are located in the remote reaches of northeastern Wyoming . . . lonely, yes, but a vital link in Baroid's supply network. Baroid, first in the field, looks ahead now, as it did long ago, and stakes claims to the largest and finest deposits of mud product minerals—guaranteeing continuous supplies of unsurpassed quality drilling mud products.

BAROID

BAROID DIVISION • NATIONAL LEAD CO.
Main Office: P. O. Box 1675, Houston 1, Texas

USE * MONEY-SAVING

Man-Tan

* It's like drilling every fifth well with no cost for mud chemicals!

EVERYWHERE MAN-TAN is being used it is reducing drilling mud costs. It can save you 20% or more on your chemical costs – that is the same as free chemicals on every fifth well!

In field after field, drillers and mud engineers are thinning their mud with MAN-TAN instead of quebracho or other expensive thinners. MAN-TAN actually costs less per bag than other tannin-type thinners and does the same work.

Baroid was first to produce *efficient* mud products. Baroid is first to offer new products that *cut mud costs*. You are losing money if your drilling crews are not using MAN-TAN now.

MAN-TAN, like other tannates, is mixed with caustic soda to secure the alkaline-tannate compound that thins drilling mud.

Start using MAN-TAN now – wherever you would use quebracho or other tannin-type thinners. Write for technical bulletin or contact your Baroid Engineer.

BAROID DIVISION
NATIONAL LEAD CO.
P. O. Box 1675, Houston 1, Texas

Please send me the latest technical literature on Man-Tan.

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE ____ STATE _____

BAROID

BAROID DIVISION NATIONAL LEAD CO.
Main Office: P. O. Box 1675, Houston 1, Texas

5608

ALCOTWINS are stocked at Beaumont, Tex., warehouse. Units derive unequalled heat-transfer characteristics from fused metal-to-metal bond between the "U" shaped fin channels and the tube. ALCO's heliarc weld provides efficient, continuous bond.

NOW FIN TUBE ALCOTWIN® EXCHANGERS CAN BE BOUGHT "OFF THE SHELF"

ALCOTWIN Units, In Many Combinations of Tube and Fin Materials, Are Stocked In New ALCO Beaumont Warehouse for Immediate Delivery

For most process applications you'll find ALCOTWIN heat exchangers in stock right now at ALCO's new Beaumont, Tex., warehouse. "Off-the-shelf" purchase of these highly versatile units can materially lower your costs in revamping processes or in building for new processes.

Many combinations of tube and fin materials are in stock. ALCOTWIN standard parts, in almost every material, are available for high-pressure and high-temperature combinations—resulting in real economy in special services.

Building-block flexibility of the ALCOTWIN units can be used to meet your present process conditions, and future load and process requirements can be accommodated easily by rearranging units.

Look into the ALCOTWIN. ALCO sales offices, and Power Machinery Corporation offices in the Southwest, have complete information. Or write P. O. Box 1065, Schenectady 1, N. Y., for brochure.

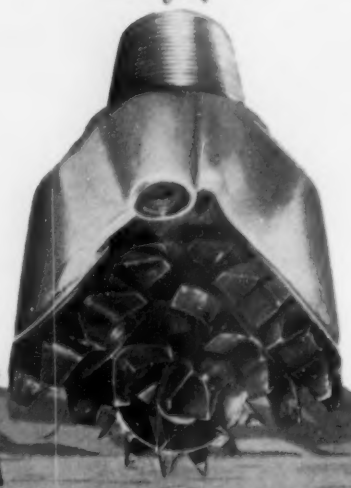
ALCO

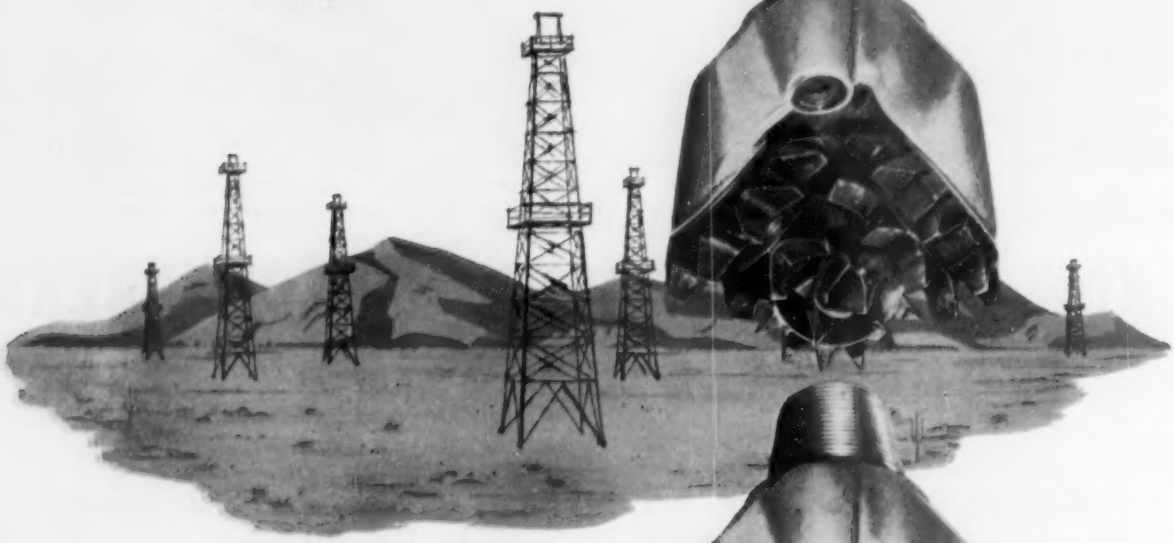
ALCO PRODUCTS, INC.
New York
ALCOTWIN Sales Agents: Power Machinery Corp.

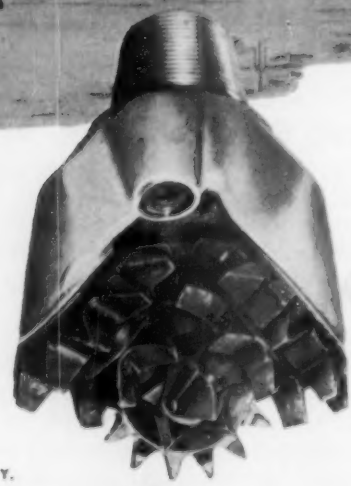
Locomotives · Diesel Engines · Nuclear Reactors · Heat Exchangers · Springs · Steel Pipe · Forgings · Weldments · Oil-Field Equipment

Do you require lightweight, fast rotation drilling for crooked hole country . . .? Or — do you need deep penetrating action for the softer formations? Whatever your specific requirements — there's a CP Bit for your exact needs! Chicago Pneumatic's complete line of Three Cone Rock Bits and Jet Bits includes seven different types for all kinds of formations from soft to exceedingly hard and abrasive.

Oil Tool Division,
Chicago Pneumatic Tool Co.,
5000 U. S. Highway 81 South,
Fort Worth, Texas.



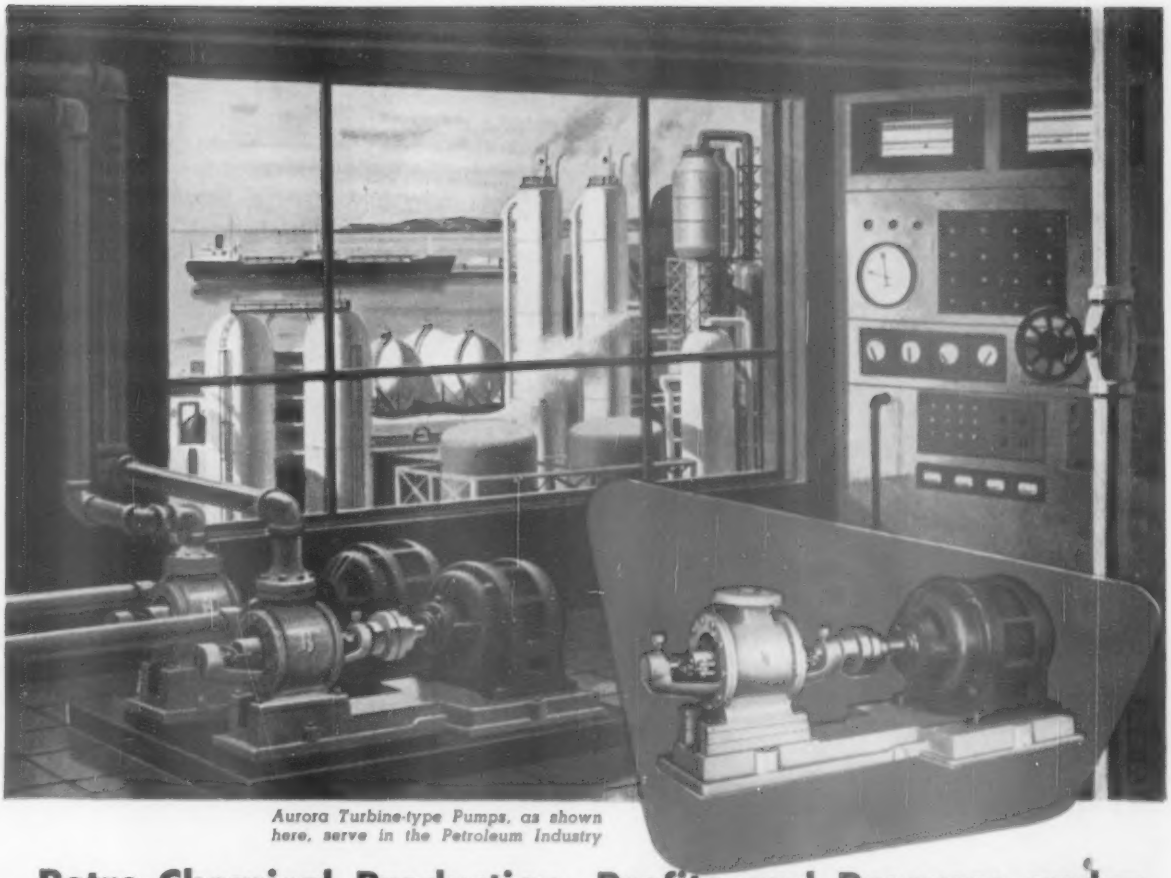




Chicago Pneumatic

GENERAL OFFICES: 8 East 44th Street, New York 17, N. Y.
IN CANADA: 10103 81st Ave., So. Edmonton, Alberta, Canada
IN MEXICO: D. F. Rosas Moreno No. 41, Mexico City, D. F., Mexico
PETROLEUM MACHINERY CORPORATION: 30 Rockefeller Plaza, New York 20, N. Y.
(Export Agent, exclusive of Mexico and Canada)

THREE CONE BITS • REAMING BITS • REAMERS • DRILL COLLARS • TOOL JOINTS • SUBS • JUNK BASKETS



Aurora Turbine-type Pumps, as shown here, serve in the Petroleum Industry

Petro-Chemical Production, Profits and Progress and—

FLUID POWER

Many industries lean heavily upon pumps for various stages of production. But in none is there a more definite tie-up between the profit and loss statement and Fluid Power than in Petro-Chem and Petroleum Refining. The movement of liquids (to perform the essential operations for converting them from raw material to finished product), entails a wide variety of conditions and requirements. There are, for example: High pressure/small volume . . . low pressure/large volume . . . accurate, metered flow . . . icy cold, boiling hot . . . acid, alkaline or neutral . . . clear clean, colloidal or semi-solid. And, for any of these conditions there's a pump bearing The New York Air Brake Company mark ideally suited to do the job. For liquid handling services: AURORA Turbine and Centrifugal Pumps and KINNEY Heliquad Gear and Rotating Plunger Pumps.

DUAL-VANE, HYDRECO and STRATOPOWER high pressure Pumps provide Fluid Power for rotary or linear motion in process automation or for added safety where toxic, flammable or explosive materials are present. There are: HYDRECO Gear Type Pumps and Motors, Valves and Cylinders for 1000/1500 psi operation . . . DUAL-VANE Pumps and Motors for 2000 psi circuits and . . . for aircraft, world-famous STRATOPOWER Piston Pumps and Fluid Motors for pressures to 3000 psi.

Finally there are KINNEY High Vacuum Pumps and complete Vacuum Systems in laboratory and high production sizes for distillation, dehydration and de-aeration.

AURORA PUMP DIVISION
Aurora, Ill.
Liquid Handling Pumps, AURORA Centrifugals and deep well Turbines, 7000 gpm, 500 ft. heads. APCO Turbine-type 150 gpm, 600 ft. heads. Condensate Return Units.

KINNEY MANUFACTURING DIVISION
Boston, Mass.
KINNEY Vacuum Pumps, 0.2 micron, capacity to 5000 cfm; KINNEY Rotating Plunger and Heliquad Liquid Handling Pumps, to 3000 gpm.

VACUUM EQUIPMENT DIVISION
Philadelphia, Pa.
Complete KINNEY Vacuum Systems, Equipment and Components, Vacuum Research and Engineering.

KALAMAZOO DIVISION
Kalamazoo, Mich.
HYDRECO Gear-Type Hydraulic Pumps, 3 to 120 gpm; Fluid Motors, 3 to 52 hp; Cylinders; Control and Auxiliary Valves; 1500 psi. DUAL-VANE Hydraulic Pumps, 3 to 120 gpm; Fluid Motors, 7 to 140 hp; 2000 psi operation.

WATERTOWN DIVISION
Watertown, N.Y.
Railroad air brake equipment of all types; STRATOPOWER Hydraulic Pumps for Aircraft, to 3000 psi.

Complete your file of data on new developments in the New York Air Brake family of advanced performance equipment. Write for catalogs today!

THE NEW YORK AIR BRAKE COMPANY

230 PARK AVENUE • NEW YORK 17, N. Y.

INTERNATIONAL SALES OFFICE, 90 WEST ST., NEW YORK 6, N. Y.

R/M Poly-V® Drive Saves Space and Weight —Boosts Power Delivery!

No matching problem . . . less shaft overhang . . . less drive weight . . . but *greater* power capacity! These are only a few reasons why the R/M Poly-V* Drive has proved the greatest advance in power transmission drive development since the multiple V-belt. No other belt drive can deliver as much power in as little space as patented R/M Poly-V Drive!

A single, endless parallel V-ribbed belt runs on sheaves grooved to mate precisely with the belt ribs. Poly-V Belt covers the entire width of the drive sheave with a continuous strength member of super-strength synthetic cord. Sheaves, therefore, can be narrower, lighter, because the uniform pull of this single unit belt delivers more power per inch of drive width. Poly-V Drive delivers up to 50% more power in the same space as multiple V-belt drives . . . or equal power in ⅔ the space!

Poly-V Drive eliminates multiple-belt "length matching" problems. Uniform power delivery and drive dependability is not limited to individual V-belt life. Speed ratios remain constant—from no load to full load. Poly-V belts are oil proof, non-spark and heat resistant. Just two cross sections of Poly-V Drive meet every heavy-duty power requirement, reducing costly belt and sheave inventories to a new low.

R/M engineers are prepared to show you how R/M Poly-V Drive has improved heavy duty power transmission in many industries . . . and how it can improve your belted drives—give you "More Use per Dollar." Contact R/M . . . or write for Poly-V Drive Bulletin #6638.

*Poly-V is a registered Raybestos-Manhattan trademark. RM 610

MANHATTAN RUBBER DIVISION—PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Other R/M products include: Industrial Rubber • Fan Belts • Radiator Hose • Brake Linings • Brake Blocks • Clutch Facings • Asbestos Textiles • Packings • Engineered Plastic, and Sintered Metal Products • Laundry Pads and Covers • Bowling Balls

UNDERCOVER AGENTS AT WORK

Dependable protection against underground corrosion is one of the most essential considerations in the installation of any pipeline. This protection usually consists of an insulating, corrosion-inhibiting coating applied to the pipe surface, with further shielding provided by a wrapper to resist abrasion and soil stress. These are the "undercover agents" that safeguard pipeline installations against corrosion leaks and deterioration.

Throughout the nation today, leading utilities and pipeline companies look to Dearborn for long-term protection of one of their most important investments—the carrier pipe that must transmit material thousands of miles to its consumer. Dearborn's NO-OX-ID Coatings and NO-OX-IDized Wrappers provide chemical and mechanical protection against moisture penetration and soil action—protection that lasts for decades—on installations under ground or under water.

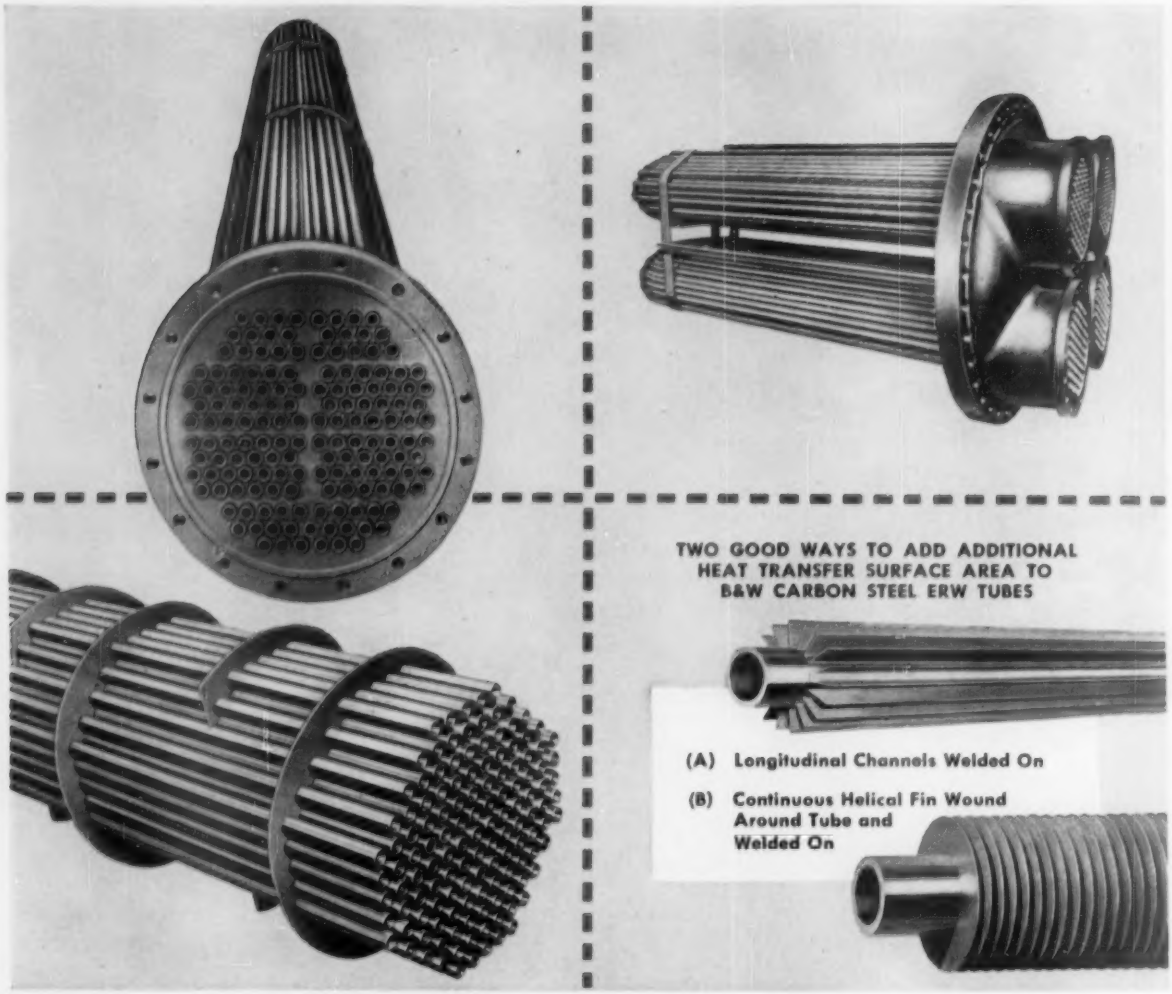
Whether applied by hand . . . by Traveliner . . . or at the mill, Dearborn Coating Combinations are your best assurance of dependable, long-life protection. On your next pipe-coating job, you'll find it pays to specify Dearborn NO-OX-ID.

Dearborn NO-OX-ID®

For Long-Term Pipeline Protection

DEARBORN CHEMICAL COMPANY
Merchandise Mart Plaza, Dept. OG, Chicago 54, Ill.
Please send me complete information about NO-OX-ID.

Name.....*Title*.....
Company.....
Address.....
City.....*Zone*.....*State*.....


TWO GOOD WAYS TO ADD ADDITIONAL
HEAT TRANSFER SURFACE AREA TO
B&W CARBON STEEL ERW TUBES
(A) Longitudinal Channels Welded On
(B) Continuous Helical Fin Wound
Around Tube and
Welded On

TUBING REQUIREMENTS FOR HEAT TRANSFER EQUIPMENT

The economy and usefulness of pressure tubing in heat exchanger and condenser applications depend on the tubing's heat transfer ability and the ease with which it can be bent, coiled, swaged, and rolled into tube sheets.

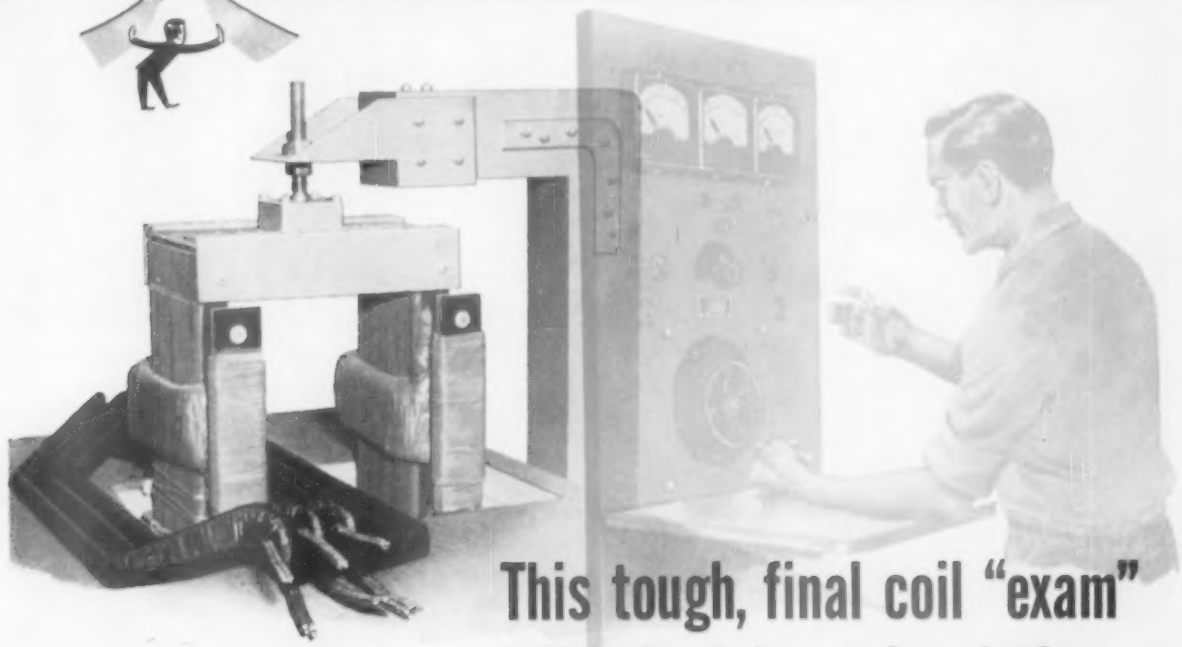
Because of its uniform wall thickness, the heat transfer ability of B&W Electric-Resistance-Welded Carbon Steel Tubing is the optimum for such a ferrous material. It is an economical material to use, not only because of its reasonable first cost, but also because of its low fabrication cost, since ease of bending, coiling, swaging, and rolling into tube sheets is provided through quality-controlled methods used in its manufacture.

B&W Electric-Resistance-Welded Carbon Steel Heat Exchanger and Condenser Tubing is widely used in the process industries, including petroleum refining and chemical processing, and in refrigeration and steam generating equipment. If carbon steel tubing can do the job required, you will find B&W ERW Tubing provides maximum, trouble-free service life. For additional information, call on Mr. Tubes, your nearby B&W Tube Representative — *or write for Bulletin 412.* The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pa.

TA 6099-GP

Seamless and welded tubular products, seamless welding fittings and forged steel flanges—in carbon, alloy, and stainless steels

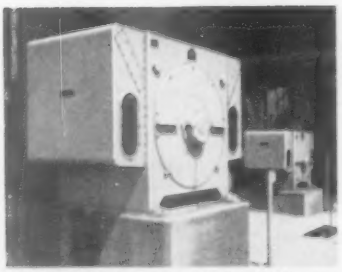
LOOK BEHIND THE "INSULATION CURTAIN" BEFORE YOU SELECT A LARGE MOTOR



This tough, final coil "exam" tells the tale on insulation

(ELLIOTT COILS GRADUATE SUMMA CUM LAUDE)

This special test equipment induces a turn-to-turn impulse voltage many times greater than anything the coil will meet in service. The slightest flaw or weakness in the insulation is instantly revealed on the test panel. It's all part of the job at the modern coil-testing laboratory at the Elliott plant. In addition to this test, many others, including all AIEE requirements, are applied to make sure every coil is fully qualified to take its place in the stator of a large Elliott squirrel-cage induction motor. The tests are tough because our standards of performance are high. Since 1948, 500,000 hp of weather-protected and 900,000 hp of indoor motors with this insulation have served *without one stator coil breakdown due to insulation failure!* That is a record that is hard to match and clear-cut evidence that you don't take a chance when you make it an Elliott Motor. Ask the Elliott field engineer for complete facts or write to the Elliott Company, Ridgway Division, Ridgway, Pa.



ELLIOTT WEATHER-PROTECTED MOTORS have a perfect seven year success record of no stator failures due to faulty insulation. The only weather-protected motor which can make such a claim.

RG-12

ELLIOTT Company

Elliott large motor insulation is "field-proven"

PIPELINE News from L·O·F GLASS FIBERS COMPANY

BLUE FLAG PROTECTS TIDELANDS PIPELINE!

The ground was so wet that water had to be pumped constantly from the ditch by the well point system shown here. ▶

City engineers of Anacortes, Washington, were faced with the problem of laying over 24,000 feet of large-diameter water pipeline—most of it through wet and muddy tidelands, an extremely corrosive environment!

To assure complete protection, Engineers Carey and Kramer specified L·O·F Glass Fibers' Blue Flag reinforcing inner wrap for the pipe, which was wrapped by American Pipe and Construction Co., Portland, Oregon.

Blue Flag pipe wrap is made of special inert glass, which resists the action of soil chemicals. The strong, uniformly porous mat acts to give you:

- increased enamel strength
- high resistance to cracking and backfill damage
- improved enamel distribution with far fewer "holidays"
- years more pipeline life

. . . all this for less than ½% of your original pipeline investment. Be sure to specify Blue Flag for your over-the-ditch or yard-wrapped pipe. It's available from strategically located distributor warehouses. For full details, write: L·O·F Glass Fibers Company, Dept. 78-116, 1810 Madison Avenue, Toledo 1, Ohio.

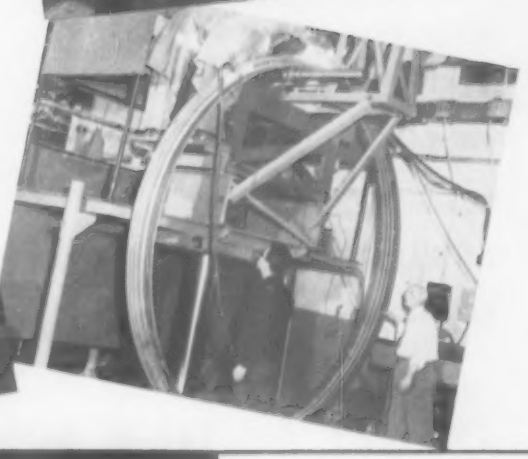
L·O·F GLASS FIBERS
BLUE FLAG PIPE WRAP

L·O·F GLASS FIBERS COMPANY

TOLEDO 1, OHIO

Makers of glass fibers by the "Electronic-Extrusion" process

A Complete Line for Pipeline Protection: BLUE FLAG Reinforcing Pipe Wrap • **DURAMAT** Protective Outer Wrap • **DURAMESH** Pipeline Fabric • **DURATAPE** Pipeline Joint Wrap



Highest quality expansion joints

Quality is built into every Sola-Flex joint. From extensive research and development programs through to precision fabrication, every step guarantees an extra measure of durability and trouble-free service. And Sola-Flex joints are economical—in initial cost and in long life. Send for a Sola-Flex catalog. Dept. C-97, Solar Aircraft Co. San Diego 12, Calif.

SOLA FLEX®

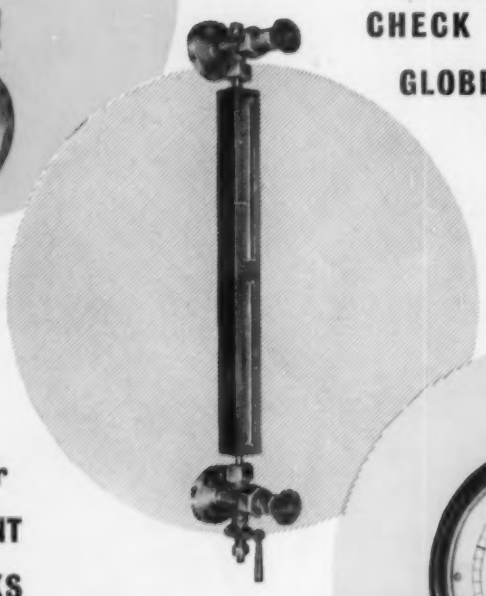
EXPANSION JOINTS AND BELLOWS

SOLAR

AIRCRAFT COMPANY

SAN DIEGO DES MOINES

VALVES AND FITTINGS FOR THE OIL AND ALLIED INDUSTRIES



Specialists in the manufacture of:

CAST STEEL AND FORGED STEEL WEDGE GATE VALVES ★ SWING CHECK VALVES

GLOBE & ANGLE STOP VALVES

SCREW DOWN STOP VALVES ★ METER VALVES

LIQUID LEVEL GAUGES

PRESSURE GAUGES

All types of Oil Valves and Fittings for CRACKING PLANT STORAGE TANKS REFINERIES, ETC.

SYDNEY SMITH & SONS

(NOTTINGHAM) LTD.

BASFORD WORKS, EGYPT RD., NOTTINGHAM, ENG.

PHONE: NOTTINGHAM 75031/2/3 *CODE: A.B.C. 5th EDITION*

GRAMS: "SMITHS, NOTTINGHAM".

London Office: WHITT & CHAMBERS LTD.

6 LYGON PLACE, LONDON, S.W.1, ENGLAND

PHONE: SLOANE 7294/5 *GRAMS: WHITCHAM SOWEST, LONDON*

New speed for the road— no job too rugged for FWD

When you pick a heavy-duty truck for today's oil operations you need a combination of speed and driving power—speed for increased highway travel and driving power for rugged off-highway hauling that is always a part of oilfield operations.

Today's big new line of FWDs is, more than ever, built for oil! The exclusive FWD power and weight proportioning; four or six wheel drive with the powered front axle; new engines with road speeds up to 65 MPH, with parts and service available anywhere . . . These are the features that give FWD versatility that takes oil jobs as they come!

Check the new line of FWD heavy-duty trucks built for well logging, cementing, petroleum transport, off-highway pipeline hauling and heavy equipment transport. They fit today's oil operations best!

Heavy-Duty Vehicle Specialists

THE FOUR WHEEL DRIVE AUTO COMPANY · CLINTONVILLE, WISCONSIN · Canadian Factory: KITCHENER, ONTARIO

Install it... then forget it!

Ball and seat of Kennametal* or Kentanium* stays *down* longer . . . cuts well downtime . . . keeps production high . . . profits *up*.

High hardness . . . extremely high resistance to wear, to corrosion, and to deformation under impact . . . Kennametal Balls and Seats stay on the job from 3 to 5 times longer than "special" or "super" alloys . . . 20 times the service of steel . . . even under the most severe conditions of ball pounding, ball-on-seat impact, sand abrasion, or acid corrosion. More oil is moved up . . . at a faster rate . . . and with fewer pump pulls, less oil well downtime. Pump repair and maintenance costs are cut.

Two grades are available. Kennametal grade KH is for use under high abrasive cutting conditions. Kentanium is recommended for use in applications where severe cage wear, corrosive sand, sulfide fluids, and seat impact are met. Kentanium, being one-third lighter than steel, greatly reduces ball-on-seat shock.

It will pay you to use Kennametal or Kentanium balls and seats to combat wear, impact failure and corrosion in your operations. For further information, contact your regular supplier, or write KENNAMETAL INC., Dept. OG, Latrobe, Pennsylvania.

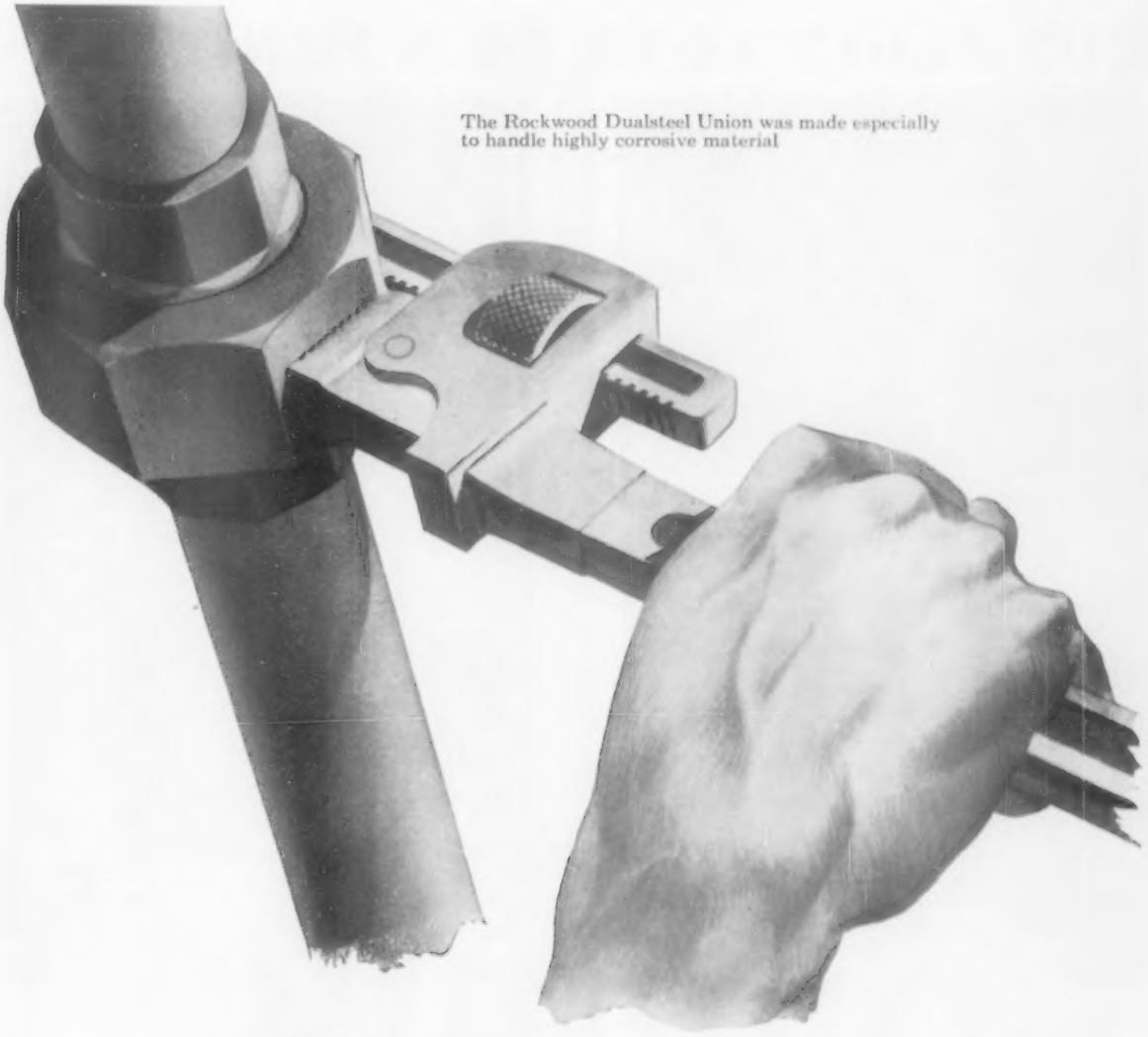
*Trademarks

Let it pound away!

A Kennametal Ball and Seat provides exceptionally high resistance to:

. . . fluid cutting	. . . ball pounding
. . . wear	. . . ball-on-seat shock
. . . corrosion	. . . electrolytic action

INDUSTRY AND
KENNAMETAL
. . . Partners in Progress



The Rockwood Dualsteel Union was made especially to handle highly corrosive material

There's nothing to worry about

It's a ROCKWOOD DUALSTEEL UNION!

Rockwood's Dualsteel Unions stand up to wrench abuse and overcome galling. The reason — Dualsteel's greater Brinell hardness.

Rockwood Dualsteel Unions are made of a new special alloy steel. This special alloy steel cannot be welded, it's tougher, more resistant to corrosion. Straight waterway eliminates corrosion and erosion at seat joint. You get greater strength without bulk!

The entire union is completely "Rockwoodized", the threads being protected by "Rockwoodizing" after having been machined. This process plus the special alloy make the Dualsteel Union ideal for the handling of corrosive material.

But there are even more reasons why Rockwood Dualsteel Unions are what you're looking for. All Dualsteel Unions are individually air tested under fluid. Their ultimate strength is 85,000 pounds per square inch.

If you want a union that will resist corrosion and overcome galling . . . a union that has more advantages — and none of the weakness of solid steel constructed unions — you want Rockwood's Dualsteel Unions.

For complete information fill in the coupon below. We'll send all the data.

ROCKWOOD SPRINKLER COMPANY

Distributors in all principal industrial areas

ROCKWOOD

ROCKWOOD SPRINKLER COMPANY
1446 Harlow Street
Worcester 5, Mass.

Please send me prices and further data on the Rockwood Dualsteel Unions.

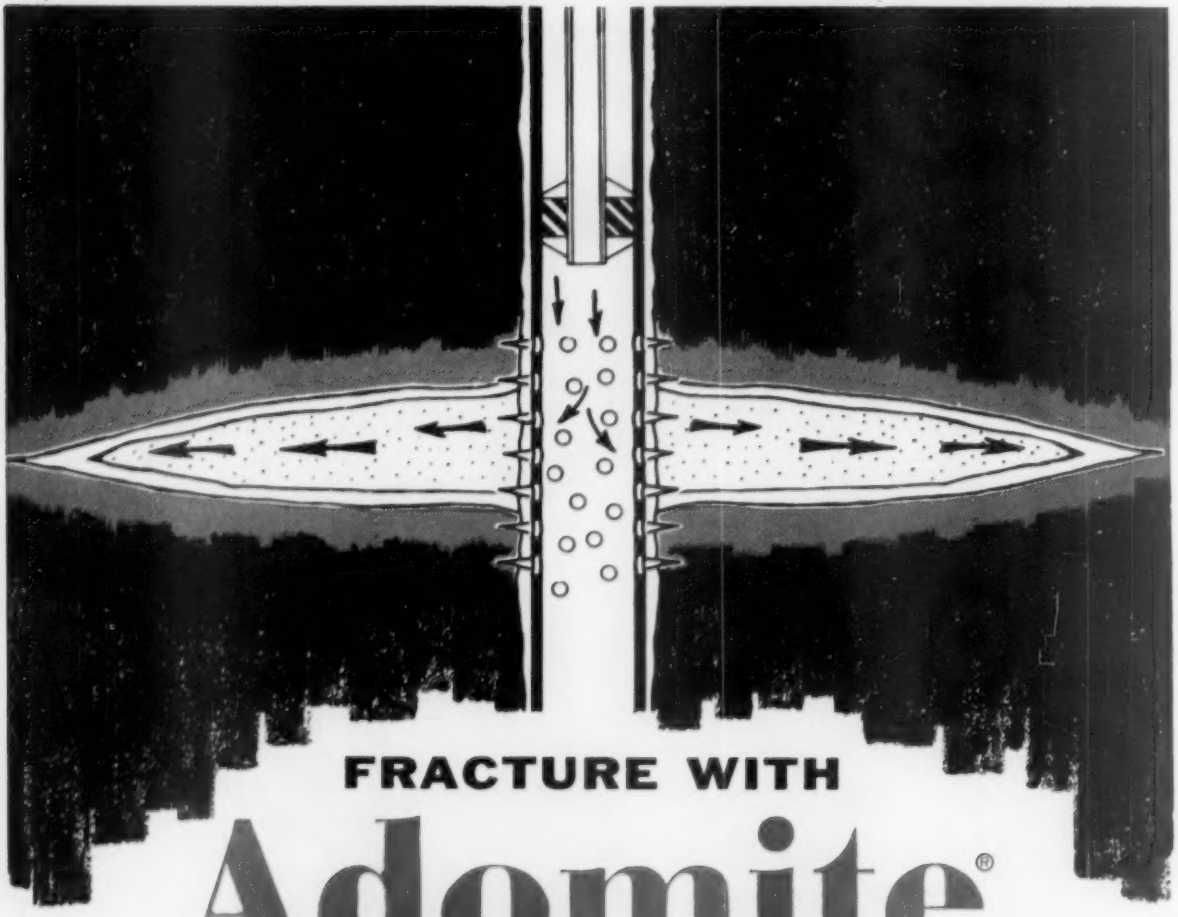
Name .....

Title .....

Company .....

City ..... Zone ..... State .....

CUT FLUID LOSS TO A MINIMUM



FRACTURE WITH

Adomite®

Specify the fluid-loss control agent proven profitable in thousands of successful field treatments

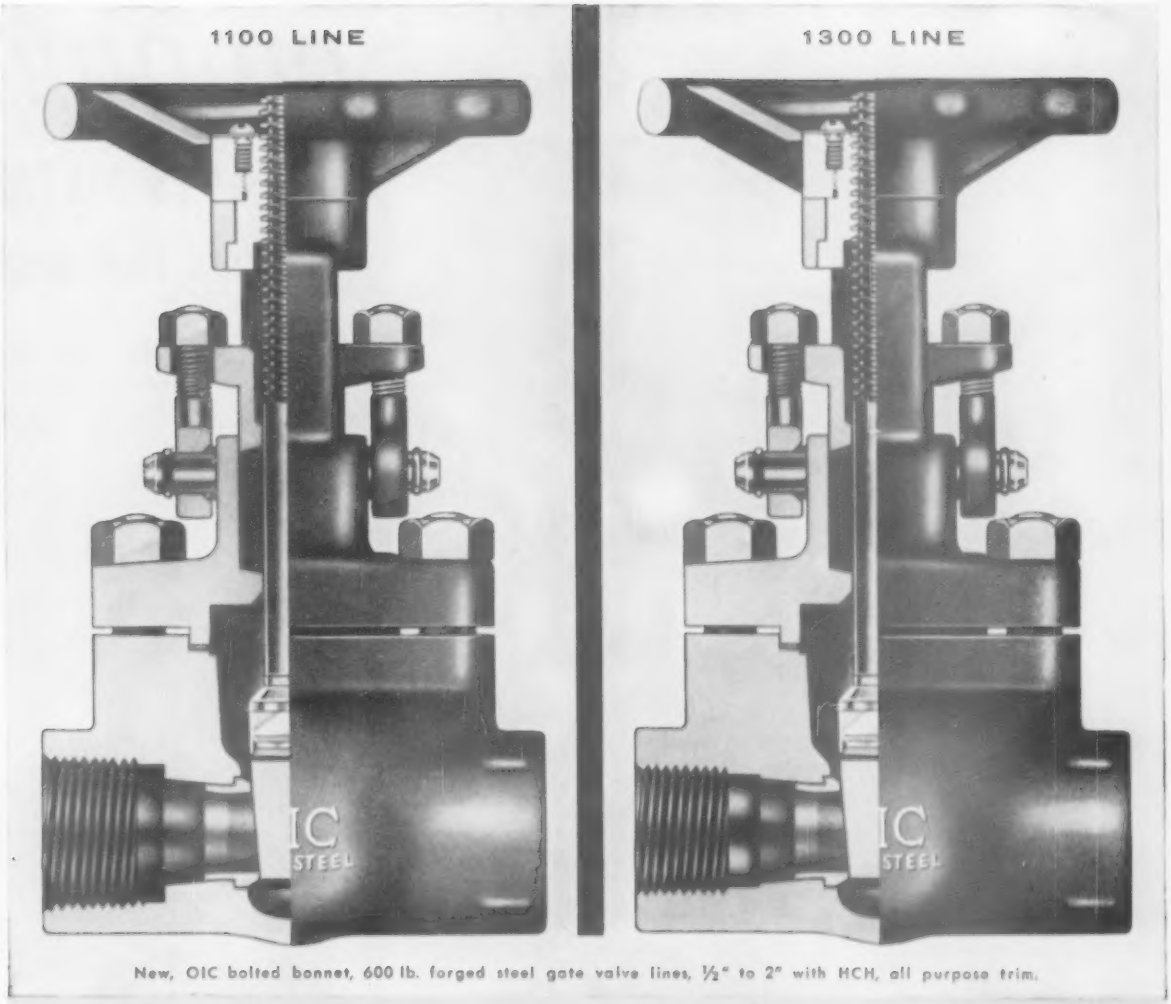
Only Adomite gives you all these advantages— so effectively	Larger fracturing per volume of treatment—or the same size fracture with a lesser volume of fracturing oil.	Acceptance of fracturing fluid by pipeline companies —fracturing oils made from lease crude and Adomite are completely acceptable to pipelines.	Fewer sand-outs. Adomite prevents loss of fluid into the rock matrix, preventing buildup of sand concentration in the fracture.
Lower transportation costs. The fracturing oil costs you nothing when you use your own lease crudes.	Decreased friction losses. The low viscosity of Adomite-treated crudes or gelled crudes permits the use of less pumping equipment than viscous refinery residuals.	Compatibility of fracturing fluid with reservoir oils. Since Adomite is used with lease crudes, the fracturing fluid is fully compatible.	Fluid loss control with one additive. Adomite is all you need to control fluid loss of kerosene, crudes, gelled crudes or refinery residuals.

© 1956, Continental Oil Company

BE SURE TO TELL YOUR SERVICE COMPANY TO USE ADOMITE

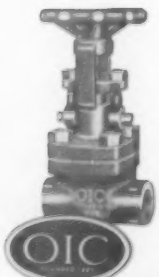
Adomite — developed and manufactured by Continental Oil Company

Adomite® — trade-mark, Continental Oil Company



New, OIC bolted bonnet, 600 lb. forged steel gate valve lines, ½" to 2" with HCH, all purpose trim.

2 new rugged OIC forged steel lines



Both feature the modern and rugged bolted bonnet joint, which simplifies and lowers the cost of maintenance.

Both feature a soft iron gasket securely retained in the bolted male and female body-bonnet connection to assure enduring tightness.

Both feature 13% chrome stainless steel trim with 1000 Brinell, duracased wedges.

Both feature plenty of gripping area for pipe wrenches on pipe ends; there's no interference with body-bonnet flanges. Simplifies joint make-up!

The 1300 line includes a *high flow* port area, offering full-flow characteristics.

The 1100 line, with standard flow ports, is compact, economical, and includes the same high quality, rugged features and trim as the 1300 line.

Most valve users have applications suited to both of these new OIC valve lines. Write for Bulletin *#195-R* illustrating features and specifications that fit these newest forged steel valves to your services.

THE OHIO INJECTOR COMPANY • WADSWORTH, OHIO

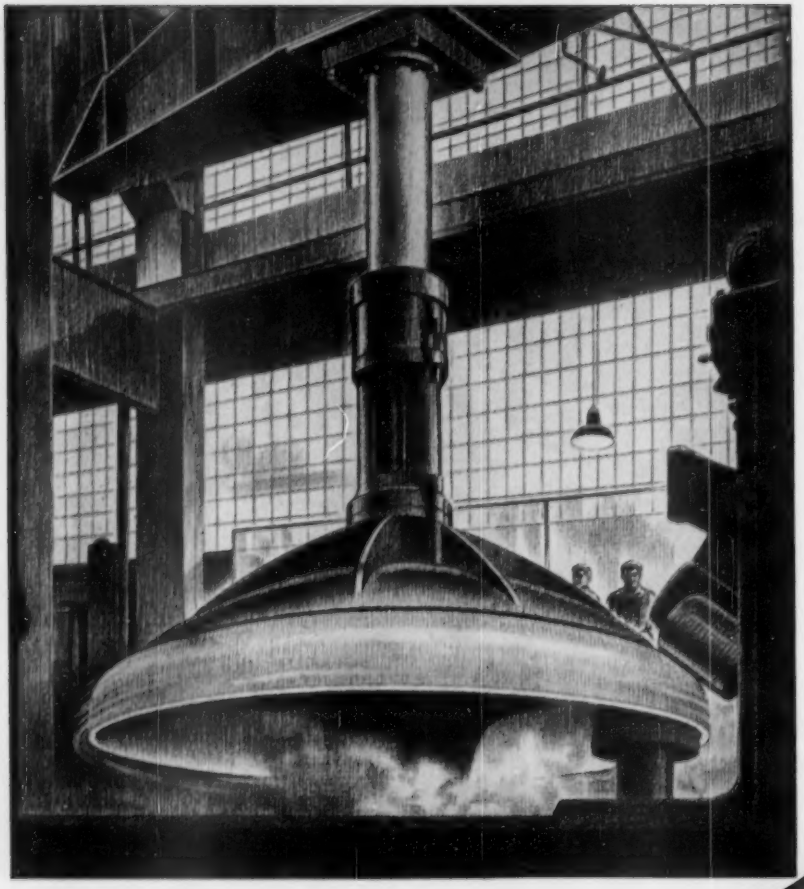
VALVES | **FORGED & CAST STEEL, LUBRICATED PLUG, BRONZE & IRON VALVES**

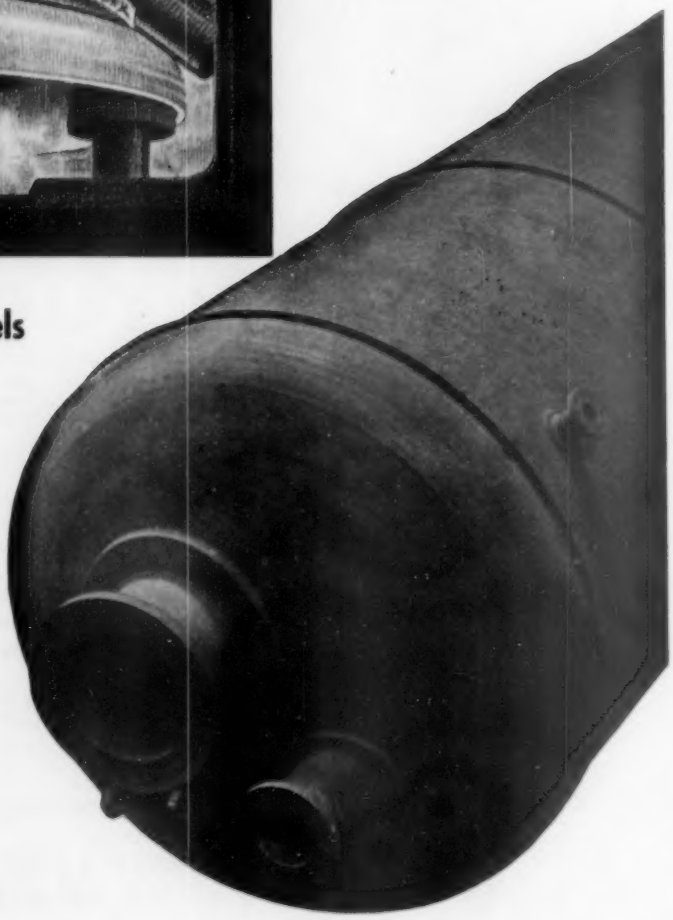
Spinning

SAVES METAL

—CUTS TOOL COSTS

The design and production of Pressure Vessels may be greatly facilitated by using dished and flanged ends spun by Harveys on the Rotarpress. They combine semi-ellipsoidal form with large knuckle radius. A substantial reduction in plate thickness can be effected, and in most cases tool costs are eliminated.





'Rotarprest' Ends for Pressure Vessels

can be supplied in Mild, Alloy and Clad Steels and Non-Ferrous Metals. The capacity of the Rotarpress ranges from 5 to 15 feet diameter, and 3/8" to 4" thickness. Knuckle radii and depth may be varied to meet individual requirements.

Please ask for List No. OG-881 giving full range of sizes.

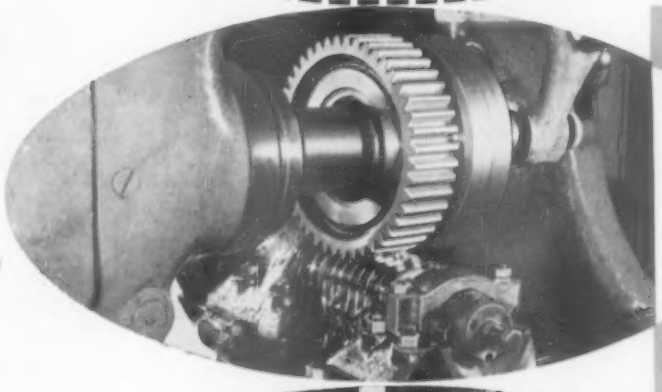
Harvey

G. A. HARVEY & CO. (LONDON) LTD.
WOOLWICH ROAD, LONDON, S.E.7
ENGLAND

Cables: "Cheaper, London"

Important reasons why it pays to use True Original Parts

Allis-Chalmers True Original Parts start right. Each benefits from one of industry's most intensive metallurgical research programs. And each is designed by experienced construction machinery engineers to do a specific job . . . with ample capacity to carry a full share of the work load just as the new equipment part did.



1

PRECISION-MADE

Skilled craftsmen bring True Original Parts to life — working with the most modern manufacturing equipment and meeting the highest industrial standards. The result: precision-made parts get full work power from your Allis-Chalmers machinery.

2

CAREFULLY INSPECTED

True Original Parts go through rigid original-equipment inspection and testing processes to assure long-life service. For example, gears are checked again and again for perfect meshing . . . for true balance . . . for full capacity.

3

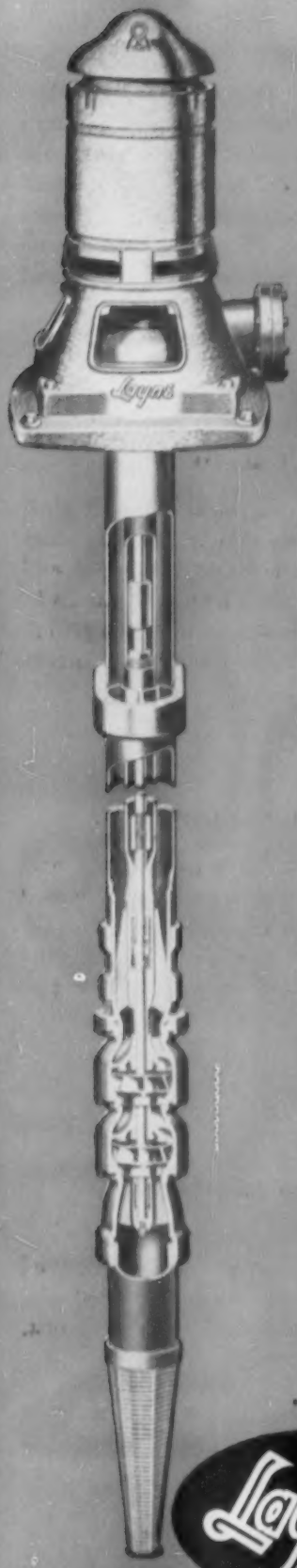
PROPERLY PACKAGED

You want your parts factory-new . . . . . and that's how you get True Original Parts. Many are specially treated . . . then sealed and packaged against rust, dust and damage.

A country-wide network of dealers stock ample supplies of True Original Parts. Whether you're working in one area or across the country, you can depend on reliable parts service close to your job from your Allis-Chalmers Construction Machinery dealer.

ALLIS-CHALMERS, CONSTRUCTION MACHINERY DIVISION, MILWAUKEE 1, WISCONSIN

ALLIS-CHALMERS



There are Many Reasons for World Leadership of...

Layne

VERTICAL TURBINE PUMPS

Tested and proved in thousands of installations of all types, the world-wide leadership of Layne pumps has led the field for one overall reason—PERFORMANCE . . . under all kinds of operating conditions.

That envied, but never duplicated, performance record has been made for many reasons. These are a few:

1. Complete and undivided manufacturing responsibility: Every part of every Layne pump is manufactured in the Layne factory to Layne high standards.
2. Concentration on one make: A lifetime of experience is behind every Layne pump . . . and that accumulated "know how" is focused on one pump alone.
3. Proven design: The basic design of a Layne pump has been job tested under every conceivable operating condition. And that design is converted into a finished unit through a series of highly specialized and quality-controlled factory operations.

To know all the reasons why Layne pumps are preferred by Industry—Municipalities—and Agriculture, write for bulletin number 100.

LAYNE
& BOWLER, INC.
MEMPHIS
General Offices and Factory

LAYNE ASSOCIATE COMPANIES THROUGHOUT THE WORLD

Layne

Water Wells • Vertical Turbine Pumps • Water Treatment

How JOHN DEERE Industrial Tractors can *Speed Your Work, Cut Your Costs*

ON big cross-country operations and on city gas distribution lines, there are many jobs that you can handle quicker, easier, and more profitably with the extremely maneuverable, versatile John Deere "420" Crawler or its companion wheel-type Utility Tractor.

With these light, compact, yet powerful tractors, you'll cut your costs decidedly in several ways—less right-of-way, street, sidewalk, and curbing damage—easy movement of equipment from job to job—lower operation and maintenance costs. In addition, "420" Tractors with equipment are simple and easy to operate and maintain—*any* man in your crew can become a proficient operator in a few hours.

Both the "420" Crawler and Utility have a powerful, economical, dependable, valve-in-head engine that delivers 25 drawbar horsepower. Present owners report operating on about a gallon of gas per hour. There is "live" hydraulic power for fast, positive operation of all equipment. A time-saving direction reverser (optional) lets you move forward or backward in the same speed —no time wasted shifting gears.

Matched equipment is available for many phases of your operation —trenchers and backhoes for digging . . . winches and side booms for moving, lining-up, and laying-in pipe . . . PTO-driven generator for cutting and welding pipe . . . loaders and dozers for backfilling and clean-up work . . . rakes and seeders for replacing right-of-ways. The Crawler with equipment can be loaded on a truck; a reasonably priced trailer is available for fast, easy transporting from job to job.

Crawler with Trencher

Crawler with Backhoe

Crawler with Side Boom

Utility with Backhoe and Loader

For More Facts See Your Nearest John Deere Dealer

JOHN DEERE Industrial Tractors and Equipment

Backed by nearly 40 years of tractor manufacture for dependable service and quality.

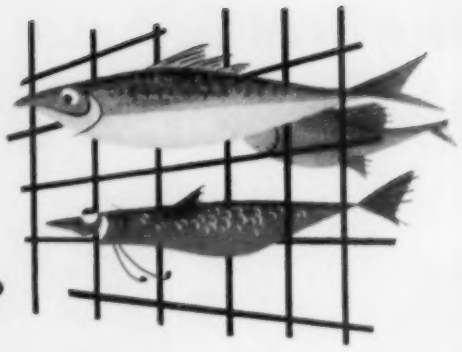
Send for FREE LITERATURE

JOHN DEERE • Industrial Division
Moline, Ill. • Dept. D46C

Please send me your latest literature on:
☐ Crawler ☐ Wheel-Type

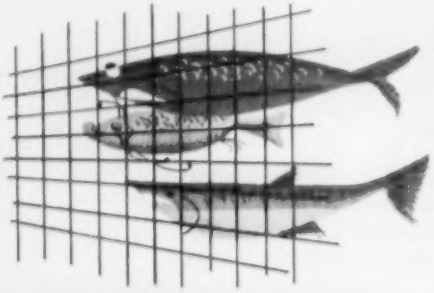
*Name*_____
*Title*_____
*Firm*_____
*Address*_____
*City*_____ *State*_____

What good is a net that the fish swim THROUGH?

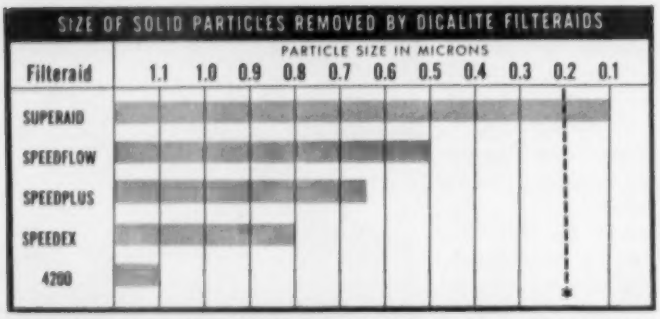


The major difficulty in securing trouble-free flood water is not the larger impurities, easy to precipitate or settle . . . it's the little devils which can slip right through when ordinary separation processes are used. These microscopic hellions . . . algae, bacteria (especially the sulfate-reducing bacteria) and chemical precipitants . . . find happy homes in the pores of the formation, grow there, increase and multiply till the formation is plugged and the water drive practically destroyed.

But they can't get through DICALITE!



SIZE OF SOLID PARTICLES REMOVED BY DICALITE FILTERAIDS



*0.2 MICRON – Theoretical limit of resolution of optical microscope. Few microscopes achieve it.
80.0 MICRONS – Smallest particle size visible to the unaided eye at 10" distance.

That's why many of the diatomite filter systems now operating on water flood projects use Dicalite Filteraids. As the chart shows, there's a Dicalite grade to filter out unwanted particulates of any size – algae, bacteria, colloidal solids – even down in the submicron range. Simple tests made by Dicalite service engineers can quickly indicate the grade and amount required for any desired clarity at optimum flow-rate.

Diatomite filter systems for water flood projects occupy only 1/5th the space of a sand system, and can be completely unitized. Capital investment is usually lower, too. So, if pump pressures are steadily rising and the water drive is slowing, investigate the many advantages of Dicalite in a diatomite filter system. Write for full information.

Dependable GLC GREAT LAKES Dicalite DIATOMACEOUS MATERIALS

DICALITE DIVISION
Great Lakes Carbon Corp.
612 So. Flower St.
Los Angeles 17, Calif.

They Say—

An Unsound Import Basis

"It is conceivable that some great new discoveries in the U. S. might for a time, cause proven reserves to advance more rapidly than consumption. But except or during such period as this might occur, it seems clear that if we are to meet our U. S. oil requirements at reasonable cost to the public and without drawing too heavily on our desirable reserve of domestic producing capacity above actual production, then imports will have to continue to increase not only in actual barrels per day, but probably in their proportion of the total supply—or certainly so as compared with 1954.

S. A. SWENSRUD

"If this is so, then it must be clear that there never was a sound basis for the idea that total oil imports into the U. S. for any great length of time could or should be held to their 1954 relationship to domestic production. Especially was this true in view of the new refineries which were under way in the Pacific Northwest, Minnesota, and the eastern seaboard at the very time the original recommendations were arrived at late in 1954 or early 1955. Most, or all, of these refineries were built with the Government's endorsement, in the way of Certificates of Necessity and 5-year amortization, well knowing that they were planned to run largely or exclusively on imported crude oil."

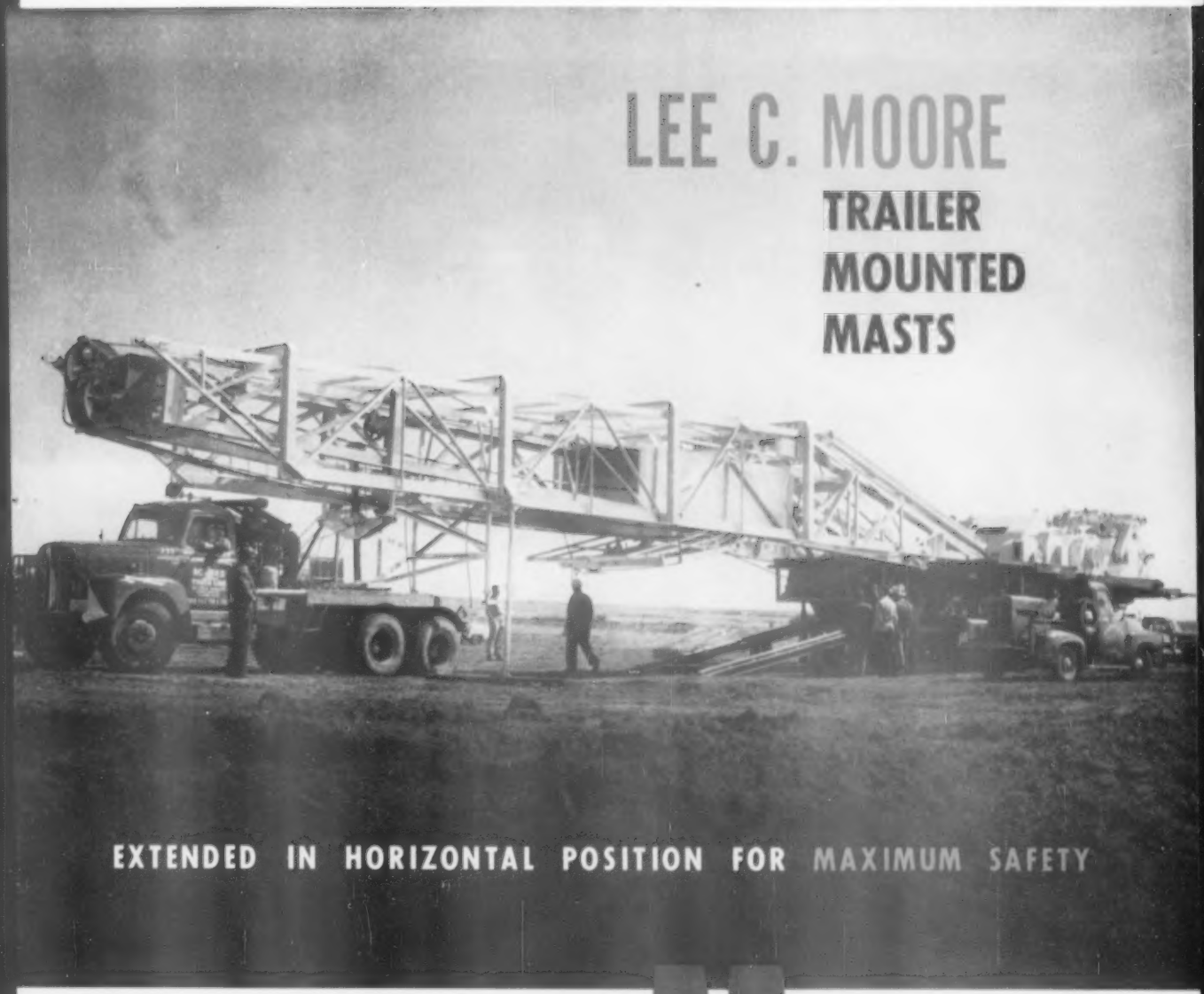
S. A. Swensrud, chairman of the board, Gulf Oil Corp., in a statement presented at the Office of Defense Mobilization hearing on imports.

Pioneer in the Making?

Dear Sir:

Since reading the "Dear John" letter in The Oil and Gas Journal, February 6, 1956, in which you wrote of possibilities in the Palo Duro basin . . . I have constantly referred to page 153 until now I can recite the letter backward or quote any paragraph therein. (It) . . . caused me so much concern and anticipation that I now have decided to put into action all the day dreaming . . . caused in these last few months.

I have made location in Castro County on the I. C. Little acreage.



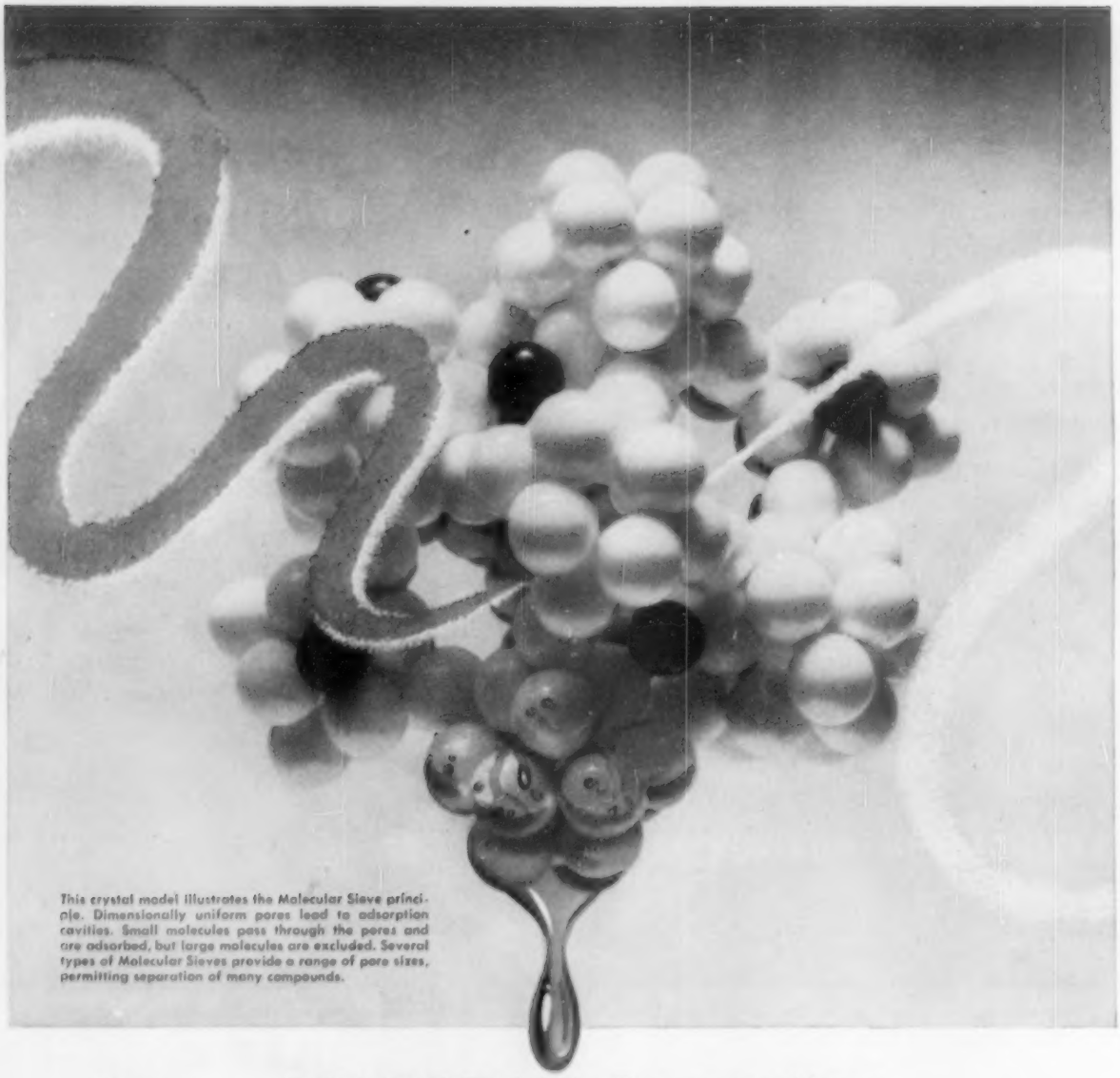
LEE C. MOORE trailer mounted masts are extended full length while in horizontal position and then mechanically raised to drilling position. This mast design has met the approval of the drilling industry everywhere because its operation is safe . . . fast . . . simple . . . dependable.

SINGLE TRAILER MOUNTED MASTS: 86 ft., 94 ft., 97 ft., 97 ft. Heavy duty, 100 ft., 126 ft. Export Model.
DUAL TRAILER MOUNTED MASTS: 97 ft., 100 ft., 126 ft., 126 ft. Export Model.

LEE C.
Moore
CORPORATION

TULSA : SHREVEPORT : GREAT BEND : CASPER : NEW ORLEANS
CENTRALIA : DALLAS : HOUSTON : MIDLAND : PITTSBURGH
EXPORT OFFICE:—ROOM 624, INTERNATIONAL BLDG., 630 5TH AVE., NEW YORK 20, NEW YORK
FOREIGN LICENSED MFR. OIL WELL ENGINEERING CO., LTD., CHEADLE HEATH, STOCKPORT, ENGLAND

Compact, Efficient



This crystal model illustrates the Molecular Sieve principle. Dimensionally uniform pores lead to adsorption cavities. Small molecules pass through the pores and are adsorbed, but large molecules are excluded. Several types of Molecular Sieves provide a range of pore sizes, permitting separation of many compounds.

Now... SELECTIVE Separation with MOLECULAR SIEVES

LINDE Molecular Sieves, a new *class* of adsorbents, offer unique performance in product purification and recovery. These crystalline zeolites provide selective separation of gas and liquid mixtures in *three* ways... difference in molecule size... or polarity... or carbon bond saturation.

Selective removal of contaminants, even in trace amounts, is possible at temperatures up to 300° F. Selective recovery of valuable stock is often accomplished without regard to relative boiling points. Co-adsorption eliminates extra processing steps by removing several impurities simultaneously. High capacity is realized through a wide range of operating conditions.

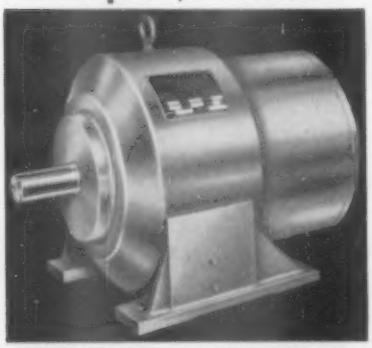
Typical uses for Molecular Sieves are the separation of n-paraffins from iso-paraffins and cyclics... extraction of olefins from refinery streams and top gases... removal of catalyst poisons from olefins... sweetening of natural gas and reformed hydrogen... purification of annealing gases.

For a descriptive booklet, "Molecular Sieves for Selective Adsorption," write Dept. O-113, Linde Air Products Company, A Division of Union Carbide and Carbon Corporation, 30 East 42nd Street, New York 17, N. Y.

Linde TRADE MARK MOLECULAR SIEVES

The term "Linde" is a registered trade-mark of Union Carbide and Carbon Corporation

Compact, Efficient



DRIVE POWER

with the Philadelphia

GEARMOTOR

These modern GearMotoRs offer the simplest, most reliable and compact machinery drives obtainable . . . featuring real economy in lowered original cost, and reduced maintenance through long years of trouble-free service. Philadelphia GearMotoRs are extremely compact and efficient. They are highly resistant to moisture, chemical fumes and abrasive dusts . . . Helical gearing with crown-shaved teeth assures ultra-fine surface finish, controlled contact at center of teeth, plus long, silent service life . . . Two-way seals lock-in oil and lock-out dirt . . . Heavy shafting of heat treated alloy steel eliminates bending or twisting under heavy loads . . . Oversize thrust bearings can handle big overhung loads . . . gear units and integral motors conform to AGMA and NEMA Standards.

Be convinced, send for Catalog GM-560 which fully describes and illustrates the new Philadelphia GearMotoRs, Utility type GearMotoRs, In-Line Reducers, and Motorized Worm Gear Drives.

UNIT TYPE	MODEL	H. P.	RATIO
SINGLE REDUCTION		1-60	1.25:1 to 5.06:1
DOUBLE REDUCTION		1-60	6.20:1 to 31.4:1
TRIPLE REDUCTION		1-40	38.5:1 to 158.9:1

phillie gear®

PHILADELPHIA GEAR WORKS, INC.
ERIE AVE. & G STREET, PHILADELPHIA 34, PENNA.
Offices in all Principal Cities

INDUSTRIAL GEARS & SPEED REDUCERS
LIMITORQUE VALVE CONTROLS
FLUID MIXERS • FLEXIBLE COUPLINGS

Virginia Gear & Machine Corp. • Lynchburg, Va.

See the newest developments in Mechanical Power Transmission at our Booth #80—22nd National Power Show, New Coliseum, New York City, November 26-30.

Well location, to be exact, 660 ft. from the north and west lines, Section 172, Block M-6 of the Stone, Kyle and Kyle Survey, site some 15 miles northeast of the Sun No. 1 Herring, and about the same distance north of Anderson-Prichard's No. 1 Fowler-McDaniel 9,200-ft. test. This latter well had some slight shows and several hundred feet of good permeability, the better part from 5,900 to 6,200 ft. Our well is scheduled for a 8,200-ft. bottom. . .

Stephens Oil & Gas Corp. owns considerable leases in the area, with Stanolind Oil & Gas holding the largest acreage. Others such as Sun, Cabot Carbon Co., Gulf, Sunray, and Ohio hold leases in the Castro County area near the well location.

Besides the Journal, several leading geologists in this area have been my consultants. Therefore, when the well is finaled, you for one, Sun and Cabot Carbon may have first-hand information. I hope to be classified as a pioneer when the well is finaled.

I. A. Stephens
Stephens Oil & Gas Corp.
Lubbock, Tex.

Natural Gas: United Divisions

"In recent years we have often heard our industry (natural gas) described and classified as divided into three generalized segments: producers, pipelines, and distributors. The time is long overdue when this description should be changed to three functional segments united into one industry. That should in no way interfere with the exercise of vigorous competition in the proper spheres.

"Public charges of unfair practices brought by one part of the industry against another tend to discredit the entire industry. The consumer just will not accept the explanation that he is dependent upon three different interests. Natural gas to him means the natural-gas industry."

J. J. Hedrick, president, Independent Natural Gas Association of America.

The Wages of Irresponsibility

"The small businessmen are today much more worried about big government than about big business. I think the big businessmen are equally worried, too. Irresponsible criticism when translated into irresponsible legislation can destroy our free-enterprise system.

"When the politicians find it so useful to assault business because they believe the voters are convinced that what is good for business is bad for them, and vice versa, then I believe that there is something quite fundamentally wrong in our society. When the institution of American politics pro-

NOW
IMPROVED
for better-than-ever
THREAD PROTECTION

MEETS TODAY'S
DRILLING DEMANDS!

MONEY BACK GUARANTEE

Sold through your favorite supply store

USE JIMMY GRAY DOPE BRUSHES

PETROLEUM DISTRIBUTING COMPANY
BOX 203 - HOUSTON, TEXAS - CApitol 8-9648

MANHATTAN PROJECT TO THE U.S.S. SEAWOLF

CATAWISSA PERFECT SEAL UNIONS HAVE HAD A PART IN EVERY APPLICATION OF

ATOMIC POWER

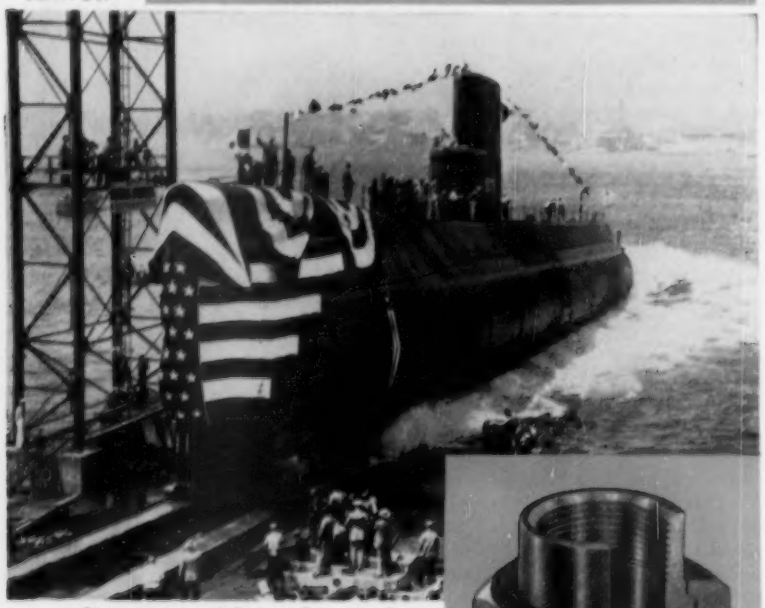
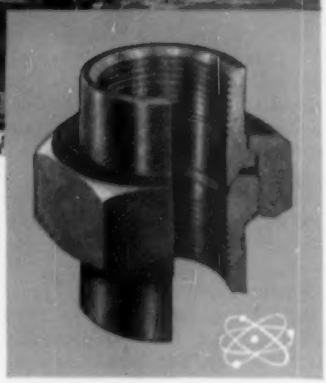


Photo courtesy of General Dynamics Corp.



LAUNCHING THE U.S.S. SEAWOLF at Groton, Conn., marked the development of the second atomic powered submarine built for the U.S. Government. Catawissa Valve & Fittings Co. is proud of its role in the project as major suppliers of Forged Steel Pipe Unions for the "Seawolf" — another repeat order in the atomic field . . . proof positive of satisfactory service!

SAFETY IS A "MUST"

From the original "Manhattan Project" to the U.S.S. Seawolf (and other unannounced atomic developments in private quarters), Catawissa Perfect Seal Pipe Unions have been specified to handle the extreme pressures involved. These are examples of "the toughest jobs", where absolute safety is a "must"!

3-TO-1 SAFETY FACTOR

One of the many extra value features of Catawissa Unions is in the very design itself — a design which gives each union a 3-to-1 safety factor. Catawissa 3000-lb. service unions, for example, are tested to 9000-lbs.; 6000-lb. service unions are tested to 18000-lbs., etc.

This point of superiority, plus expert workmanship and 40 years of experience, make Catawissa Forged Steel Pipe Unions and Swing Check Valves the best buy for rugged, trouble-free service wherever dependable performance is required.

PERFECT SEAL SEATING

Another Catawissa exclusive is its Ball-to-Angle seat design, which assures a Perfect Seal even when the two pipes joined are not in alignment.

ALL PRESSURES, TEMPERATURES

The Catawissa line is the most complete line of unions on the market—regular or special! They're hot forged from solid bars of AISI Spec. C-1026 steel, and meet the requirements of ASTM Spec. A-105, Grade 2.

YOU CAN TAKE THE GUESSWORK OUT OF PIPING PROBLEMS

. . . specify CATAWISSA Perfect Seal Pipe Unions & Swing Check Valves

• AT YOUR FAVORITE SUPPLY STORE •

CATAWISSA VALVE & FITTINGS CO.
CATAWISSA • PENNA.

motes defamation of the institution of American business, the long-range welfare of all the people is severely threatened."

Robert G. Dunlop, president of Sun Oil Co., in a speech before Beta Gamma Sigma Alumni of New York.

Increase Imports Are Inevitable

"It appears inevitable that the United States will have increasing need for foreign oil supplies in the years ahead. This is because, despite the intensive search of the domestic industry for new oil, the U. S. has the highest ratio of production to known reserves of any major producing country.

"It is obviously crucial to utilize substantial and growing volumes of foreign oil. And it is important that the entire structure of the industry be permitted to adjust gradually toward increasing proportionate use of foreign supplies, including the further development of American-controlled foreign reserves.

"A cutback in petroleum imports would have the effect of temporarily forcing the industry in the reverse direction, and would interrupt this necessary adjustment, as well as causing an unnecessary drain on our invaluable remaining domestic oil reserves. Clearly this would be detrimental to national security. . . ."

The Texas Co. statement presented at the Office of Defense Mobilization hearing on imports.

"Man-Made" Rubber Outlook

"The differential between the price for man-made rubber and natural rubber that now prevails will encourage still greater use of man-made rubber both here and abroad. Fortunately, world inventories of man-made rubber are the highest since World War II. Facilities for producing man-made rubber have been expanded to allow further increases in its use."

John L. Collyer, chairman of the board, B. F. Goodrich Co.

Suez and a Tight Steel Market

"One measure of Suez's potential impact upon heavy plate producers is the government program for building 50 supertankers which is being considered by President Eisenhower and his advisers.

"Such a program would suddenly create a need for some 750,000 tons of heavy steel plate from an industry already operating at capacity. This amount of steel is one and one-half times the tonnage that the present shipbuilding program is taking this year.

"Even if the proposed supertanker program is not authorized, it appears that the market for heavier-gage plate

CAN TYPE VERTICAL PUMP

Now Available in Two Types—FOR APPLICATION to CHEMICAL PROCESSING, REFINING TECHNIQUES, CONDENSATE SERVICE, AND LINE BOOSTER SERVICE

NEW DESIGNS PROVIDE BOTH A PROCESS TYPE AND A TRANSFER TYPE

The process type vertical Hydro-Line pump, especially suited to refining and process pumping offers the following features—1) API-ASME code welding; 2) especially designed containers for either mechanical shaft seals or packing; 3) availability of head and barrel flanges up to 300 lbs. or more; 4) extra heavy wall thicknesses for maximum stability and high safety factor; 5) elliptical barrel bottom design for optimum fluid entrance conditions. The transfer type Hydro-Line pump is of a similar design to the process type differing in materials of construction required for less rigorous service. Both types are extremely flexible in installation, are easy to inspect, service and maintain—can be designed for operation on any available system NPSH. Write for new Bulletin No B-1700.

THE PEERLESS

HYDRO-LINE

ENCASED CLOSE-COUPLED PUMP

CAPACITIES TO	3000 gpm
HEADS TO	1000 feet
DRIVES	As required, vertical solid shaft, or explosion-proof motors; steam turbine.
TEMPERATURES	Up to 400° F.

PEERLESS PUMP DIVISION

FOOD MACHINERY AND CHEMICAL CORPORATION

Factories at: Los Angeles, Calif., and Indianapolis, Ind. *Offices:* New York; Atlanta; Chicago; St. Louis; Indianapolis; Phoenix; Fresno; Los Angeles; Dallas, Plainview and Lubbock, Texas; Albuquerque, New Mexico.

Distributors in Principal Cities; Consult your Telephone Directory.

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION
301 West Avenue 26, Los Angeles 31, California

Please send me a copy of Peerless Hydro-Line Pump Bulletin No. B-1700.

NAME _____

ADDRESS _____

TOWN _____ STATE _____

O. & G. J.

will remain tight through 1957 at least and it is expected to remain generally tight for at least the next 5 years."

Charles Lukens Huston, Jr., president, Lukens Steel Co., in a statement to the financial analysts of Philadelphia.

Risky Contract Signatures

"It is really surprising that contracts are considered binding unless they are made with minor children, insane persons, and sovereign governments."

Robert L. Minckler, president, General Petroleum Corp., in a speech before the Seattle Chamber of Commerce.

A Less Vulnerable Economy

"One has only to look at a map of this continent to see the pattern of future development.

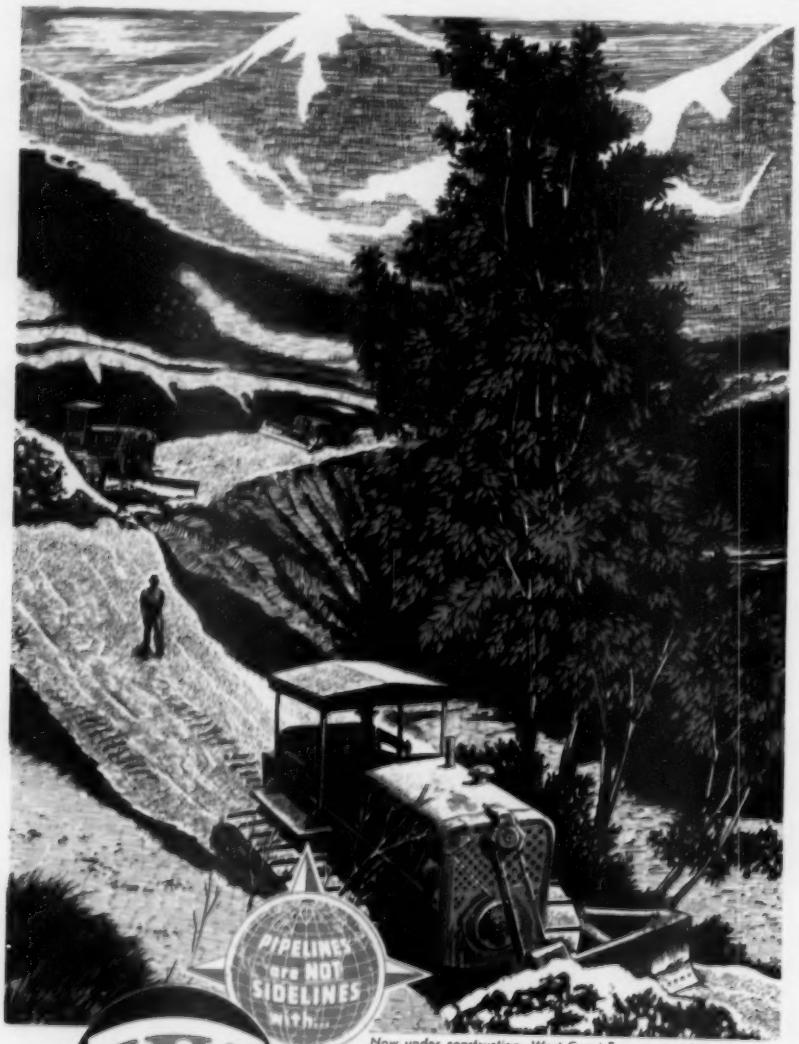
"In the heavy industrial areas of the United States and Eastern Canada we have an industrial machine with an insatiable appetite for raw materials which must be supplied if our economy is to survive.

"In northwestern Canada lies the last great storehouse of untouched resources available to the industries of this continent. . . .

"On this continent we can build an economic hegemony which, while it can never be self-sufficient, can at least be less vulnerable to those sudden changes in international trading policies which may from time to time threaten our prosperity.

"It is therefore to our mutual advantage that the natural resources of Canada should be developed in such a way as to benefit our people and yours."

T. C. Douglas, premier of Saskatchewan, addressing the Independent Petroleum Association of American, Dallas.



Now under construction: West Coast Transmission Line

WILLIAMS BROTHERS

ENGINEERS and CONSTRUCTORS

HOT BLDG. • TULSA, OKLAHOMA • CABLE ADDRESS: WILLBROS

New York • Washington • Louisville • Minneapolis • New Orleans

CANADA • BOLIVIA • COLOMBIA • ECUADOR

VENEZUELA • ENGLAND

OIL • GAS • WATER • PRODUCTS PIPELINES • PUMPING STATIONS

CALENDAR OF EVENTS

NOVEMBER

25-27 Kansas Independent Oil and Gas Association, nineteenth annual meeting, Broadview Hotel, Wichita.

25-30 American Society of Mechanical Engineers, Statler Hotel, New York.

26-28 Conference on Solvent Extraction, sponsored by Oklahoma A.&M. College, Stillwater, Okla.

26-30 National Exposition of Power and Mechanical Engineering, sponsored by American Society of Mechanical Engineers, Coliseum, New York.

27-30 American Chemical Society, National Chemical Exposition, Cleveland.

30 Natural Gasoline Association of America, Panhandle - Plains regional meeting, Herring Hotel, Amarillo, Tex.

DECEMBER

3-4 New Mexico Oil and Gas Association, annual meeting, Alvarado Hotel, Albuquerque.

3-5 Air Pollution Control Association, national semiannual technical meeting, Rice Hotel, Houston.

6-8 American Petroleum Institute, Oil Industry Information Committee meeting, Biltmore Hotel, New York.

6-8 Interstate Oil Compact Commission, annual meeting, Fontainebleau Hotel, Miami Beach, Fla.

9-12 American Institute of Chemical Engineers, annual meeting, Statler Hotel, Boston.

11-12 Water Quality Control for Subsurface Injection, conference sponsored by the University of Oklahoma, Norman, Okla.

1957

JANUARY

14-16 Pipe Line Contractors Association, ninth annual convention, Boca Raton Hotel and Club, Boca Raton, Fla.

14-18 Society of Automotive Engineers, annual meeting, Sheraton-Cadillac and Statler hotels, Detroit.

21-25 American Institute of Electrical Engineers, 1957 winter general meeting, Hotel Statler, New York City.

FEBRUARY

8-9 American Society for Testing Materials, Symposium on composition of

"Ford Power saves us money on the tough jobs"

We've never owned an engine with Ford's ability to dig in and hang on in tough going. On our present job we're breezing right through 18 inches of frozen ground, and doing so with no noticeable increase in operating costs."

—MR. ORVILLE SNEDEGAR
Newcastle Excavating Co.
Newcastle, Indiana

Mr. Snedegar operates a model 510 Unit Challenger, manufactured by the Unit Crane and Shovel Corp., Milwaukee, Wisconsin. Powered by a Ford "172" Heavy Duty Industrial Engine, the Challenger—as a clamshell, hoe or dragline—makes short work of *any* excavation job.

Ford Power is at work on all types of construction projects everywhere, *and with good reason*. For who else but Ford offers the industry a *full line* of modern overhead-valve 4-, 6- and 8-cylinder gasoline engines? And who else but Ford offers Short Stroke design and rigid deep-block construction in *every* engine?

Short Stroke design cuts friction, reduces engine wear and releases more *usable* power . . . power that goes to waste in ordinary engines. Deep-block construction combines with a host of other exclusive engineering advancements to make Ford Industrial Engines the heavy-duty endurance champs they are.

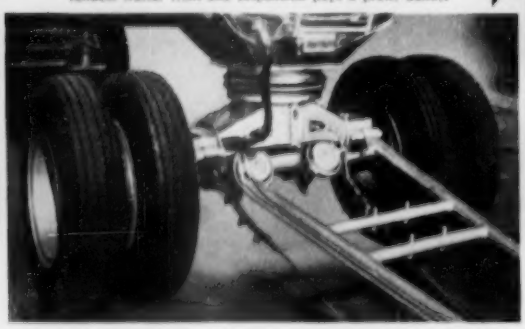
Little wonder, more and more every day, profit-minded operators are swinging to reliable, low-cost Ford Power. Why not you?

And remember . . . to better serve users of industrial power, a network of newly appointed Ford Industrial Products Dealers has been set up across the nation. Now there is a Ford Industrial Power Headquarters in *your* area.

Ford
INDUSTRIAL ENGINES
AND POWER UNITS

Write or phone today for complete information: INDUSTRIAL ENGINE DEPARTMENT
FORD Division of FORD MOTOR COMPANY P.O. BOX 598, DEARBORN, MICHIGAN

Another A. O. Smith research advancement — this "Different" tandem trailer front-end suspension pays a profit bonus.



EVERY 100,000 MILES, this "5th wheel" adds 20,000 ton-miles of payload

HERE'S a "5th wheel" with earning power for tandem trailers. Truckers save about 400 lbs. on every unit . . . enjoy a profit-bonus of extra payload on every trip.

Ingenious design of the A. O. Smith "5th wheel" promotes easier handling . . . a "better-following" trailer. Construction eliminates costly ball and roller bearings . . . simplifies maintenance.

An important advancement indeed—the "5th wheel" is especially important as an example of what happens when the creative resources of A. O. Smith research are applied to a profit problem. Want more facts about this and other A. O. Smith products of progress? Write for free booklet.

Through research . . . a better way

A.O.Smith
CORPORATION

MILWAUKEE 1, WISCONSIN

12 plants in New Jersey, Pennsylvania, Ohio, Wisconsin, Illinois, Texas and California

International Division: MILWAUKEE 1, WISCONSIN

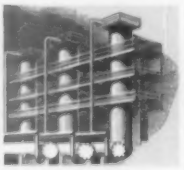
A.O.Smith
CORPORATION

For facts about any of the products shown here — write A. O. Smith Corp., Milwaukee 1, Wisconsin

Permaglas home heating and cooling systems

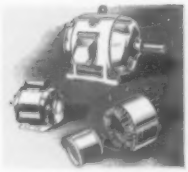
Permaglas and Burkay water heaters

Harvestores for the farm Permaglas Storage Units for industry


Pressure vessels, heat exchangers

Line pipe, oil well casing

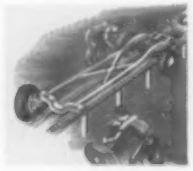
Liquid meters, gasoline dispensers


Electric motors

Welding machines, electrodes, accessories

Permaglas smoke stacks

Glass-lined and stainless tanks


Automotive frames and parts

Glascote processing equipment

petroleum, Jung Hotel, New Orleans.

13-15 National Association of Corrosion Engineers, Tulsa section, eighth annual short course for pipeliners, Hotel Mayo, Tulsa.

17-18 Engineers, Joint Council, Statler Hotel, New York.

22 Natural Gasoline Association of America, Permian basin regional meeting, Scharbauer Hotel, Midland, Tex.

24-28 American Institute of Mining, Metallurgical and Petroleum Engineers, annual meeting, Hotels Roosevelt and Jung, New Orleans.

MARCH

3-6 American Institute of Chemical Engineers, regional meeting, the Greenbrier, White Sulphur Springs, W. Va.

6-8 American Petroleum Institute, Southwestern district production division meeting, Statler-Hilton Hotel, Dallas.

11-15 American Institute of Chemical Engineers, regional meeting, Philadelphia.

11-15 National Association of Corrosion Engineers, Kiel Auditorium, St. Louis.

12-13 Subsurface Geology Symposium, fifth annual conference, sponsored by the University of Oklahoma, Norman, Okla.

20-22 American Petroleum Institute, southern district production division meeting, Washington-Youree and Captain Shreve Hotels, Shreveport, La.

25-27 Western Petroleum Refiners Association, annual meeting, Hilton Plaza Hotel, San Antonio, Tex.

27-29 American Power Conference, Sherman Hotel, Chicago.

APRIL

1-4 American Association of Petroleum Geologists, national convention, Kiel Auditorium, St. Louis.

2-4 Corrosion Control, fourth annual conference, sponsored by National Association of Corrosion Engineers and the University of Oklahoma College of Engineering, University of Oklahoma, Norman, Okla.

7-10 Petroleum Equipment Suppliers Association, annual convention, Palm Springs, Calif.

7-12 American Chemical Society, national meeting, Miami, Fla.

10-12 American Petroleum Institute, Mid-Continent district production division meeting, Mayo Hotel, Tulsa.

11-13 American Institute of Mining, Metallurgical, and Petroleum Engineers, Pacific Northwest Regional Conference, Portland, Ore.

16-18 Southwestern Gas Measurement Short Course, University of Oklahoma, Norman, Okla.

16-18 National Petroleum Association, fifty-fourth semiannual meeting, Cleveland.

24-26 National Gasoline Association of America, thirty-sixth annual convention, Rice Hotel, Houston.

24-26 American Petroleum Institute, Rocky Mountain district production division meeting, Gladstone, Townsend, and Henning Hotels, Casper, Wyo.

28-30 Independent Petroleum Association of America, midyear meeting, Buena Vista Hotel, Biloxi, Miss.

29-30 Automatic Control in the Petroleum and Chemical Industries, conference sponsored by the University of Oklahoma, extension study center, University of Oklahoma, Norman, Okla.

29-May 1 Southern Gas Association, annual convention, New Orleans.

Dry Moisture Twice As Fast!

USE
MOBILBEADS
(Formerly Sovabeads)
IN YOUR DEHYDRATOR!

- Nearly double dehydrator efficiency.
- Maintain efficiency at temperatures as high as 120°F.
- Provide longer desiccant bed life.
- Eliminate caking, reduce channeling, dusting and pressure drops.

Ask Your Socony Mobil Representative About Mobilbeads

SOCONY MOBIL

SOCONY MOBIL
Process Products

SOCONY MOBIL OIL COMPANY, INC.
150 East 42nd, New York 17, N. Y., and Affiliates: MAGNOLIA PETROLEUM CO., GENERAL PETROLEUM CORP.

THE *pump* IS THE *heart* OF OIL PRODUCTION

Sargent BUILDS THE BEST PUMPS

SALES and SERVICE

CALIFORNIA Long Beach, Bakersfield, Santa Maria, Ventura, Taft, Huntington Park

OKLAHOMA Oklahoma City, Pawhuska, Seminole

TEXAS Odessa, Snyder, Fort Worth, Houston, Sundown, Wichita Falls, Quitman

NEW MEXICO Hobbs

KANSAS Chase, Russell

ILLINOIS Grayville

ARKANSAS Magnolia

COLORADO Rangely

Sargent pumps are the heart of the oilwell producing industry. Sargent builds every API designed pump with metals to fit any and all well conditions, plus a highly efficient rodless bottom hole hydraulic pump.

The responsibility of the oilfield operator is to economically produce oil. Sargent's thirty-six years of experience in building deepwell pumps, qualifies the statement that Sargent builds the pump to do the job.

Sargent provides the most complete service facilities in the industry by company trained experts in the heart of the oilfields through Sargent operated field stores.

Sargent pumps give you more for your money because they are the best pumps built anywhere.

"GOOD WILL" is the disposition of the pleased customer to return to the place where he has been well treated.

— U. S. Supreme Court

Standard of Excellence *Since 1920*

Sargent

ENGINEERING CORPORATION

MAIN OFFICE AND PLANT

2533 E. FIFTY SIXTH ST. • HUNTINGTON PARK, CALIF.

BUILDS PUMPS THAT BUILD GOOD WILL

The OIL AND GAS JOURNAL

TULSA, OKLAHOMA

Published every Monday by The Petroleum Publishing Co., 211 South Cheyenne Avenue, Tulsa, Okla. Phone Diamond 3-6291. Founded in 1902. Name changed to The Oil and Gas Journal in 1910 by Patrick C. Boyle.

•

P. C. LAUINGER
President

S. H. ROURKE
Executive Vice President

MITCHELL TUCKER
Vice President and Advertising Manager

HANSON B. PIGMAN
Circulation Manager

DONALD W. WILSON
Manager Industry Census Department

J. PARKER HOLLAND
Production Manager

ADVERTISING OFFICES

TULSA
211 South Cheyenne, Diamond 3-6291
JOHN D. REILLY . . . Mid-Continent Manager
PREN G. HOLLINGSWORTH . . . Representative
D. B. MILLER . . . . . Classified Adv. Mgr.

NEW YORK
500 Fifth Avenue, LOngacre 4-6160
E. S. KLAPPENBACH . . . Eastern Manager
JAMES W. BROWNLEE . . . Representative
HARRY B. BULLEN . . . . . Representative

PHILADELPHIA
1509 Land Title Building
Broad and Chestnut Streets, RI 6-0118
JOHN W. MEANY, JR. . . . District Manager

CHICAGO
105 West Madison Street, CEntral 6-2537
DAVID T. KENNEY . . . . . District Manager
KAREL WEGKAMP . . . . . District Manager

DETROIT
204 Washington Square Building,
Royal Oak, Mich., LIncoln 7-9455
JOHN D. YODER . . . . . District Manager

PITTSBURGH
106 Nelson Avenue, FRemont 1-7775
ALFRED M. JONES . . . . . Manager

HOUSTON
Sterling Building, CA 4-7726
JOHN M. SPEARS . . . Gulf Coast Manager

DALLAS
1238 Mercantile Bank Building, STerling 3074

LOS ANGELES
650 South Grand Avenue, VAndike 0722
GEORGE O. RUPPERT . . . . . District Manager

ENGLAND
National Provincial Bank Chambers,
15 Grafton Street, Altrincham
Phone Altrincham 3160
HARRY BECKER . . . European Representative

•

Subscription rates to the petroleum industry, United States and foreign, 1 year, $4.00; 2 years, $7.00; 3 years, $8.00. Single copies: regular issues 50 cents; special issues $1.00. Back copies when over a year old, $1.00. Note: Payments from outside the U.S.A. may be made by international money order, New York Exchange, or check on a U.S.A. bank. Entered as second-class mail matter at Tulsa, Okla., under Act of March 3, 1879. Copyright 1956 by The Petroleum Publishing Co.

Member
Audit Bureau of Circulations
Associated Business Papers

JOURNALLY SPEAKING . . .

Musings at the A.P.I.

WHEN we told the taxi driver "Conrad Hilton," he guffawed "Aha, a rich oil man, huh? Boy, you guys sure are dropping a lot of money in Chicago this week. It's wonderful for the taxi business." Just for that we didn't give him any tip at all . . . Decided to start a one-man campaign to offset the popular idea that everybody connected with the oil industry is filthy rich and lousy with dough . . . Probably won't do any good, though . . . Everybody else around here seems to be in a generous mood . . . But it makes you wonder how the industry can ever convince the public that it's hard up as long as its representatives have such a reputation for throwing money around.

What that taxi driver didn't know, of course, is that about half the men here—and probably most of the big spenders—aren't strictly oil men but are equipment, supply, and service men . . . They may or may not be any richer, on the whole, than oil operators, but at conventions they act richer . . . Seem to have unlimited expense accounts to entertain clients and potential clients . . . And sales competition seems to take the form of outdoing the other fellow in lavish entertaining . . . It's wonderful for us free loaders, but the tales that get out to the public make it look as though the A.P.I. meeting is principally a bacchanalian revel.

Does anybody do any work at the A.P.I.? . . . Seems as though all 6,000 are standing in the lobby talking to friends or up in the hospitality suites being entertained by supply men . . . Sure is a swell way to meet friends, though . . . Just stand still any place in the hotel and sooner or later you'll see half the people you know in the industry . . . People from all over the world . . . This is a mighty friendly industry, whatever else you want to say about it . . . Sure nice to see all these people again . . . Swell chance to catch up on what's going on . . . Bet that's the main reason half the people come here . . .

Of course a lot of people do work at the A.P.I. . . . For instance, we counted 150 committee meetings scheduled on the program . . . Those boys on committees really tend to business . . . The work they do is pretty much unsung, but it keeps the A.P.I. in business . . . Some of them, we happen to know, came here just for the committee meetings and then went back to their jobs without getting so much as a single salted peanut at any of the free-loader stations. . .

Which reminds us that most of the people we see here are pretty much the top brass of the industry, the elite, the creme de la creme, the men who have arrived . . . There seem to be thousands of them, but we know that back in the oil patch there are hundreds of thousands of lesser lights working at their jobs to keep the industry going . . . Working on salaries, too . . . All oil men aren't rich . . . The top brass you see around the A.P.I. may be rich, but they aren't playboys . . . They're too busy with meetings and conferences to make much whoopee . . . too serious minded . . . too respectable . . . too old . . .

One really serious and hard-working group around here is the A.P.I. staff . . . They have several thousand bosses here watching them and giving them orders . . . So you don't see them doing much partying . . . They seem to be on the go 24 hours a day all week . . . Good thing, too . . . If it weren't for them this shindig would really be a madhouse . . . Come to think about it, it's remarkable how they have everything so well planned and arranged that the whole meeting clicks like clockwork . . . Talk about unsung heros . . . Somebody ought to give the staff medals . . .

Then, of course, there's us hard-working members of the oil trade press . . . More than half a hundred of us here . . . Each one concentrating on a different facet of this big meeting . . . Pounding out thousands and thousands of words of copy for the information of the working oil men who stayed home . . . Really work, too . . . Our dogs are barking from standing around interviewing people . . .

Better go back to the press room and write a story right now . . . But of course a fellow needs a little relaxation and sustenance . . . Part of our business to be sociable and make contacts, you know . . . Besides, we might run into somebody who would give us a good story . . . Where did you say that big party is going on? . . .

—*Henry D. Ralph.*

For Permanent-Type Well Completions

THE BAKER

RETAINER PRODUCTION PACKER

PRODUCT NO. 415D

BAKER PACKERS
ADD PERMANENCE TO
PERMANENT-TYPE WELL COMPLETIONS

When you select a Packer for a Permanent-Type Well Completion, remember this fact: of all the tools used in permanent-type well completions, only the *Packer* is required to be *permanent*. Guns, Extensions, Plugs, Gas-Lift and Circulating Valves can be removed or replaced on wire line . . . but the Packer, like the casing, is required to perform for the life of the selected producing intervals. Baker Packer Completions are Permanent Completions from the standpoint of packer performance.

Advantages of Baker Retainer Production Packer in Permanent-Type Well Completions:

PERMANENT, RELIABLE PACK-OFF will hold against any pressure differential from above or below that is safe for the casing.

FREE TUBING STRING . . . neither set-down tubing weight nor tubing tension required to achieve and maintain pack-off. Tubing can be anchored to Packer if desired.

CAN BE USED AS A SQUEEZE OR A PRODUCTION TOOL.

MEETS PERMANENT-TYPE WELL COMPLETION DIMENSIONAL REQUIREMENTS.

CAN BE SET ON WIRE LINE. PERMITS EASY REMOVAL OF TUBING STRING.

READILY DRILLABLE IN CASE OF EMERGENCY OR NEED.

BAKER OIL TOOLS, INC. HOUSTON • LOS ANGELES • NEW YORK

Don't jump the gun on increased demand

THE sudden scramble for crude oil on the Gulf Coast as a result of the Middle East crisis is not a reversal of the domestic supply demand situation for the entire industry.

So far it is—and for some time will be—largely a local phenomenon. It is not a bonanza for anybody except producers who can easily reach tanker loading docks on the gulf. To act as though this ended all oversupply problems will bring on even more serious conditions of oversupply in many areas.

THE ABILITY OF REFINERIES in Europe to use U. S. crude is limited by the number of tankers that can be routed here. And at present there is enough crude at or en route to gulf ports to fill scheduled tanker liftings. There is no need to build inland crude stocks higher.

The demand for crude is not severe enough for purchasers to take the less desirable grades, nor to pay unusual transportation charges to get it to tanker docks. It may be weeks or even months before that much of a premium is put on crude.

In the meantime, those producing areas remote from tidewater should hold the line on production and keep output to the actual market demand for their crude. If they don't, they may find their markets and pipelines more glutted, and their price structures weaker than before.

If the present condition continues for, say, 3 months, crude stocks generally will be worked down. Then, as supply and transportation arrangements are reshuffled, the higher demand for crude will spread farther from tidewater. Gradually pipeline proration will be ended. Unconnected wells will be hooked up. And purchasers will absorb trucking charges.

Only then will it be sensible to talk about general increases in producing rates and crude prices.

THE PRICE OF CRUDE depends on what refiners can get for products, and that means chiefly gasoline. Right now there's entirely too much gasoline. Europe doesn't want it. Gasoline stocks must be reduced before the products market can support a crude increase.

If U. S. refineries—particularly inland refineries—step up their crude runs prematurely, the oversupply of gasoline will get worse. And if inland producers force more crude onto such refineries, they will increase the general imbalance.

The solution is for the entire industry to move slowly right now. There's enough slack in the system to let us wait and see how the ball rolls. Hasty action to increase supplies where they are not yet needed could make things get worse before they begin to get better.

ANCHOR

has no other business except to serve YOU . . .

Anchor buys and sells LPG, Natural Gasoline, Diesel Oil, Fuel Oil, Asphalt, Commercial Solvents and Other Petroleum Products. Many refiners and producers sell their entire production to Anchor, because they know that Anchor can market better, more economically and with much less trouble than they can. They know that, in the long run, they actually make more money when they deal with Anchor due to reduced personnel and office costs. So, why don't you let Anchor take over your marketing problems? Call Anchor—Tulsa, CHerry 2-7261.

ANCHOR PETROLEUM CO. • TULSA

SALES OFFICES: Des Moines, Shreveport, Toledo, Houston, Long Beach, Okla. City, Midland, Texas, Fresno, Seattle, Salt Lake City, E. Paterson, N. J., Hattiesburg, Miss., Macon, Ga., Minneapolis, Minn., Calgary, Canada

Current and significant in . . .

The Industry This Week

Processing

• **A thorough review of safety measures** taken in refineries may result from Indiana Standard's Whiting fire. Indiana's general manager of manufacturing told the A.P.I. a new look at conventional design and operations of processing units is in order. P. 132.

Ethylene production will get a shot in the arm on two fronts. Jefferson Chemical plans a big expansion at its Port Neches plant, P. 147, while Commercial Solvents and Columbia Gas are developing plans for a new plant in the Ohio Valley. P. 151.

Pipelines

• **A 26-in. crude line from West Texas** to the Gulf Coast is in the making. Pipeline executives huddling at the A.P.I. drafted tentative plans for the line. But lack of pipe could delay construction until at least 1960. P. 144.

Pipeliners are generally agreed that at least an additional 500,000 bbl. of crude can be moved daily to the Gulf Coast. P. 127.

A new over-water pipeline-coating process may solve some of the problems currently facing pipeliners. The new idea is to extrude a rubberized asphalt-mastic weight coating directly onto the pipe, which can immediately be laid. Among its advantages are: A greater negative buoyancy and a minimum of curing time. P. 140.

Exploration

• **The Sahara Desert may turn up** a better field than earlier reported. The French claim SN REPAL's recent discovery in the arid Algerian interior has 60 ft. of pay sand and reserves of 7,000,000,000 bbl. P. 152.

Checkerboard leasing apparently will be the pattern for California's tidelands. The State Lands Commission has chopped up 62,000 acres and retained blocks in the checkerboard. P. 141.

Middle East Crisis

• **First flow of Gulf Coast oil** is slowly starting toward Europe replacing supplies blocked by Middle East hostilities. Foreign purchasers are on coast trying to buy all they can. Domestic buyers also are active and state agencies are increasing allowables. Big question still: Will pipelines have capacity to move enough oil to tidewater and will there be enough tankers to carry it to Europe? P. 142.

General Interest

• **It's pay-out time for offshore operators,** Conoco's Ira Cram reports. There are bright prospects for big oil fields in the tidelands but the big present job of operators there is slashing expenses across the board. P. 138.

Shippers have a new record to shoot at. The world's biggest tanker, the 84,730-ton Universe Leader, docked at San Francisco last week with 557,480 bbl. of crude. The big ship is on the run from Sumatra to San Francisco, hauling crude to Standard of California's Richmond terminal. P. 150.

But as the Universe Leader was unloading, plans for even bigger ships were brewing in Washington. The Maritime Administration says negotiations for 31 ships, including several in the 100,000-ton class, are being made. P. 146.

BIGGEST GATHERING of oil industry lured 6,394 through this A.P.I. registration booth in Chicago's Conrad Hilton Hotel.

Public Trust Is New Top A.P.I. Goal

CHICAGO.—Oil men generally appear dissatisfied with the meager results of the industry's public-relations program.

In fact, it was the dominant theme of the thirty-sixth annual meeting of the American Petroleum Institute here last week.

The theme was clearly evident in several of the formal addresses on the program—and even more so in informal discussion among industry leaders.

The dissatisfaction stems from the continued distrust of the industry evident in large segments of state and federal government. This indicates that the industry's efforts have not been reflected in a friendly attitude on the part of the public's elected representatives.

Cases cited . . . Most commonly cited example of failure was inability to get a new natural-gas law and the vicious anti-industry attacks that grew out of debates on that measure.

Also frequently mentioned were the continual sniping at the percentage depletion provision of the tax laws, legislative proposals to regulate pricing and marketing practices, and a general distrust and suspicion of oil men by government officials at all levels.

"Obviously our public-relations program has not been highly effective," A.P.I. President Frank Porter told his press conference with a wry smile.

And Frank O. Prior, president of Indiana Standard, declared that "we are unbelievably ineffective when it comes to influencing legislation."

Changing program . . . Quite aware of the general industry criticisms of its work, the Oil Industry Information Committee recast its program into what it calls its "new look."

Too much stress has been put on the importance of petroleum to modern life, on the size and extent of the industry, and on its forward looking research, it was decided.

But the O.I.I.C. admitted, people are not sure that this powerful and essential industry really has the public interest at heart. So it will now put more emphasis on ethical, moral, and social contributions, to show that oil men do have a social responsibility.

As expressed by one speaker, the image of efficiency, power, and ability is of no particular value in combating creeping socialism and unfair tax and legislative treatment. The people are looking for something much more than those qualities when it comes to social and economic problems.

What to do . . . Specific suggestions for improving things covered a wide range. They included much closed-door consideration of establishing a strong office of the A.P.I. in Washington with authority to speak for the industry promptly and authoritatively.

But there was no disagreement with two frequently mentioned remedies:

. . . Industry unity. There must be more mutual trust and more serious efforts to eliminate causes of intraindustry squabbles.

"If we don't have confidence in ourselves, how can we expect the public to have confidence in us," one leader asked.

. . . Gaining public good will for the industry. This must be the number one job of everybody in the industry.

Since public approval is the industry's most pressing problem, it must become the most urgent matter for every individual who lives by the industry. Only by establishing confidence at the bottom—at the local level—can the foundation be laid for industry confidence in high places.

Porter warned in his president's message that in today's world oil and politics never can be kept completely separate.

"Oil is a king on the chessboard of world politics," he said. "This industry . . . must work closely with governments for the nation's welfare and security."

Pipeliners Look Ahead

New ideas, Middle East crisis get attention, but new plan for moving emergency crude has yet to be developed

CHICAGO.—New ideas in pipelining, plus the impact of current projects, shared attention with the industry's job in transporting emergency crude last week.

The formal A.P.I. program for pipeliners was featured by automatic custody transfer of crude oil, which made its bow in actual operations this year.

But private talks among pipeliners in the corridors were concerned more with such matters as:

. . . **The Middle East** crude loss, and the extent to which U.S. pipelines will be called on to help fill the gap in world supply. Particularly affected are lines from West Texas to the gulf.

. . . **Impact of the projected** conversion of the Little Inch pipeline from gas to products on transporting and marketing patterns.

. . . **New crude and products** lines, plus expansion of existing systems and prospects for chemical lines.

. . . **Fast-growing Canadian** pipelines, with new expansions announced before current ones are completed.

Middle East . . . The effect of spot sales by Humble Oil & Refining Co., Shell Oil Co., Gulf Oil Corp. and other major West Texas producers is sporadic so far.

With the uncertain status of the Middle East supply and the newness of the emergency, a pattern of pipeline movement has yet to develop.

Pipeline companies say they have not reached the point of merging lines to handle any increased load. The capacity is available to move at least an additional 500,000 bbl. daily to the Gulf Coast. But sales so far reported privately are less than half this volume.

Canadian lines . . . Canadian crude lines, in both the east and west, are watching Suez developments as they affect their operations.

Both the Interprovincial Pipe Line Co. and Trans Mountain Oil Pipe Line Co. have major expansions under way. The projected Interprovincial extension to bring Canadian crude to the Montreal market served by the Middle East and Venezuela will be spurred by recent developments.

Trans Mountain, looking ahead to new refineries in the Pacific Northwest and a piece of the California market, has started engineering studies for a looping program for 1958.

Bechtel Corp. is looking into how much looping would be required to raise capacity to 300,000 bbl. daily within 2 years. This program was announced even before the completion of new pump stations to raise capacity to 200,000 bbl. daily by mid-1957. Trans Mountain now is able to deliver 184,000 bbl. daily from Alberta to the West Coast of Canada and the U. S. but throughput has not reached that level.

Expansion will be geared primarily to new refinery construction in Washington. Trans Mountain will be ready to move whatever volume is required when U.S. Oil & Refining Co., The Texas Co., Standard Oil Co. of California, and Richfield Oil Corp. move ahead with planned or proposed plants.

Although there may be some increase in spot tanker shipments to California from the line terminal at Vancouver, B. C., Trans Mountain's big market will continue to be the Puget Sound area. And the company is already talking in terms of 400,000 to 500,000 bbl. daily deliveries in the not-too-distant future.

One of the major products expansions in Canada which interested pipeliners at the A.P.I. meeting is Trans Northern Pipe Line Co.'s project. New pumping stations will increase capacity by 30 per cent to 60,000 bbl. per day.

Little Inch . . . Products pipeline companies and marketers from the Gulf Coast to the East Coast are waiting for a Federal Power Commission decision on conversion of the Little Inch.

If Texas Eastern Transmission Corp. receives authority to convert the 20-in. line from Beaumont to Moundsville, W. Va., it may set off a chain of events.

One result being talked is a possible products line from Philadelphia to Pittsburgh.

Also foreseen is a series of laterals from the Little Inch to expand into markets along the system of the old war emergency pipeline.

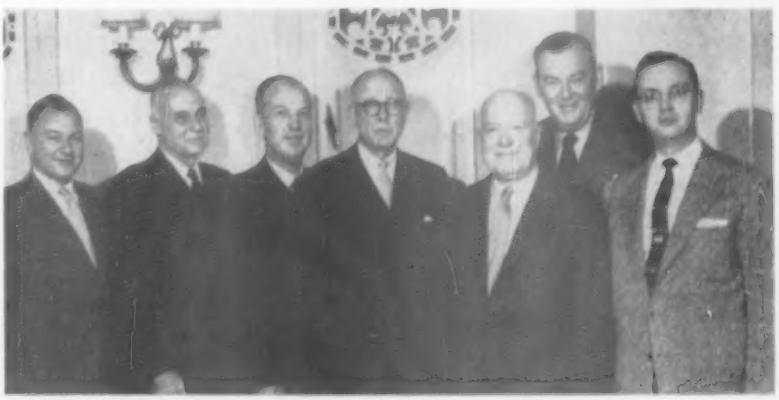
The persistent desire of railroads to get into the pipeline business came in for some attention from company executives. This interest is not new on the part of railroads, which have steadily lost ground in both crude and products transportation. But the number of companies which are being approached with offers to build joint projects along railroad right-of-way is causing pipeliners to take notice.

New ideas . . . Engineers were concerned with automatic custody transfer, new controls, new engines, and new ideas such as chemical lines.

Engineers received a report that the first engine-driven centrifugal compressor for a natural-gas pipeline has withstood initial operating tests very well. One manufacturer said that the gear—biggest stumbling block to acceptance of engine-driven centrifugals—"had not given 5 minutes of trouble."

Chemical lines . . . A products pipeline executive said he is looking forward to the day when pipelines will be in the chemical-transportation business.

Prime candidates suggested for pipeline movement are alcohol and nitrogen fertilizer solutions, for which the long-range demand outlook is for a continued increase.



OFFICERS OF THE A.P.I. and its Division of Transportation are shown before attending a group session at the Palmer House. Left to right, are: F. R. Pratt, secretary of the division's general committee, Socony Mobil Oil Co., Inc.; B. Brewster Jennings, A.P.I. treasurer, Socony Mobil Oil; Jake Hamon, chairman of the board, A.P.I.; F. O. Prior, Standard Oil Co. (Ind.), who presided at the group session; Frank Porter, A.P.I. president; Charles S. Jones, A.P.I. director, Richfield Oil Corp.; and Charles E. Spahr, vice chairman of the general committee of the Division of Transportation, Standard Oil Co. (Ohio).

New Good-Will Slant

Ethical standards of the oil industry will be stressed next year in a broadened A.P.I. public-relations theme

CHICAGO. — Oil's public-relations program is going to take a new tack next year.

It will continue to point up the industry's services and the fact that it is fully competitive—not monopolistic. But it will also stress the "good citizenship" theme.

This new approach to lining up public good will was outlined here last week at a special session of the A.P.I. annual meeting.

Richard Rollins, retiring chairman of the Oil Industry Information Committee, public-relations division of the American Petroleum Institute, pinpointed the target when he told his A.P.I. audience that:

"Our program will be geared to placing new emphasis on the ethical, moral, and social contributions. We shall endeavor to show that oil men share and treasure the identical desires and aspirations common to every American and that we have a social responsibility."

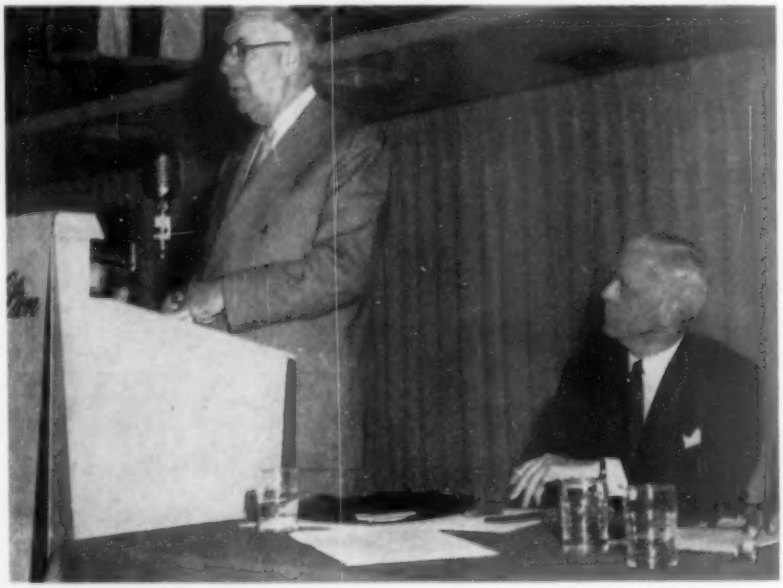
Rollins is secretary and director of public relations for Atlantic Refining Co. of Philadelphia. He and others emphasized that the broader program did not mean the dropping of any of the essential O.I.I.C. activities "which have been well established during the past 10 years that the A.P.I. public-relations activities have been in its care."

Advertising dropped . . . It was decided, however, to discontinue advertising in national publications for a year. But trade journal and related advertising will be stepped up "where deemed advisable." So will the work of the 14 offices of the O.I.I.C. field organization.

Dropping of national advertising will cut $600,000 off the budget for 1957, lowering the approved funds to $2,600,000. It was emphasized that this phase of the program might be picked up again in the future, but that funds might be put to better use at this time in other phases of public-relations work.

The decision to press home the moral and ethical standards of the petroleum industry is tied in with the growing theme among oil men that public relations is everybody's responsibility and that each person in the industry is responsible for "putting oil's best foot forward."

The theme was echoed effectively by John L. McCaffrey, chairman of International Harvester Co. who stressed that good public relations "is not just the responsibility of a department



AT THE MICROPHONE is John L. McCaffrey, chairman of International Harvester Co. At right is Richard Rollins, retiring chairman of the Oil Industry Information Committee, who was principal speaker at the A.P.I.'s public-relations special session.

H. S. M. BURNS PRESENTED certificates of appreciation from the Oil Industry Information Committee to these 10 men. They are, front row, left to right, Rod Huber, Gulf Oil Corp.; M. S. Hauser, Ohio Oil Co.; Burns, chairman of the A.P.I. board's public-relations committee and president of Shell Oil Co.; Richard Rollins, Atlantic Refining Co.; Franklyn Waltman, Sun Oil Co. Second row, left to right, Clarel Mapes, Mid-Continent Oil and Gas Association; Hal Curtis, Shell Oil Co.; Philip C. Humphrey, A.P.I.; Robert A. Douglass, Ethyl Corp.; Arthur J. DeBlois, DeBlois Oil Co.; and Roy Glass, Socony Mobil Oil Co., Inc.

created for that purpose, but is everybody's job."

The job ahead . . . The industry must go further than just reciting its accomplishments and telling how well its products serve the public, McCaffrey added.

"When it comes to social and political problems which affect everybody, I believe the people are looking for something much more than those qualities. The man in the street must believe that our conduct is motivated not only by considerations of profit, but also by many other considerations.

Another segment of public relations that will get a bigger billing on the 1957 program is the educational phase. O.I.I.C. was commended for work in this field during the past year, which saw booklets, films, and other material dealing with petroleum distributed to approximately 10,000 schools. This and other O.I.I.C. activities are under supervision of H. B. Miller.

M. S. Hauser, director of public relations for the Ohio Oil Co., was selected to serve as national O.I.I.C. chairman in 1957.

Refiners Offer Aid

Processors dissatisfied with U. S. crisis planning

CHICAGO.—Independent U. S. refiners are dissatisfied because they have not been consulted by government agencies in developing oil plans during the Middle East crisis.

The Independent Refiners Association of America meeting here last week urged that full consideration be given to the impact upon independent refiners of any program adopted by the Government. The resolution also pledged cooperation of the group but asked that any increase in posted prices of crude be accompanied by compensating advances in products.

In other action the association:

. . . **Reiterated opposition** to any sale of Universal Oil Products Co. which does not give full protection to independent refiners for services given them through the years in refinery research and development.

. . . **Approved action** of the Armed Services Petroleum Purchasing Administration in permitting small refiners to participate in the Government's purchase of petroleum products.

M. H. Robineau, president of Frontier Refining Co., Denver, was reelected president of the association. Other officials are W. E. Slaughter, president of Aurora Gasoline Co., vice president; and James P. Dunnigan, secretary-treasurer.

Gas rationing in the U. S.? No. But Europe definitely

Depletion is still with us . . . But stocks are the problem

Industry Still Has Its Problems

CHICAGO. — Frank Porter fidgeted with a package of matches, alternately lighting the stub of a cigar and then letting it go out.

Then flash bulbs popped, television camera started whirring, and reporters began their questions. The annual press conference with the president of the American Petroleum Institute was under way.

In brief, President Porter said this:

. . . **The industry should work** toward getting a new gas bill, "but we'll need a blessing from somewhere."

. . . **We need more emphasis** on indoctrination of oil-company employes. The public-relations program must be an individual employe affair, just as political campaigns are won by ringing doorbells.

. . . **There's been too much** production, refining, and imports in recent months. Stocks are at extremely high levels. If some refiners should step up runs because of the Middle East emergency and before product demand actually increases, we could get into serious trouble.

First call on the United States is expected to be for crude, because Europe wants to keep its refineries running. Products will be demanded only when crude isn't available. Even then, there won't be much call for gasoline.

. . . **Don't look for rationing** in this country. There's plenty of oil available.

. . . **It might be advisable** to go slow about jumping crude-oil production. Much crude oil is now in storage, and it probably would be wisest to lower these stocks before bringing a big volume of new crude out of the ground.

A.P.I. Meeting

Conoco Statistics "Talk"

Streamlined reports give management concise picture of the business; it means decisions can be made easier

CHICAGO.—One major oil company has eliminated top-level confusion caused by a welter of statistical reports. And instead Continental Oil Co. now has a streamlined set of reports. They give management a concise picture of its business and clear facts on which to base new decisions.

Continental's solution to a problem common to all industry aroused great interest last week among executives attending sessions of the A.P.I.

Need for clear financial reporting is becoming acute as industry grows more complex and competitive. The rapid growth of the oil industry also is dictating decentralization of management. And this cannot succeed without good control reports to relieve executives of poring over voluminous documents.

What's the answer . . . Continental was forced to hunt a solution to the problem a few years ago because it wanted to start an expansion program and decentralize its management.

Conoco called in John G. McLean, then a faculty member of the Harvard Graduate School of Business and now a company vice president. McLean was handed the job of developing an entirely new report which:

. . . Gives a quick review of the past history of a department.

. . . Summarizes current results as compared to both the past and to the current program.

The graphs, charts, and key figures he decided to present provide the overall picture of operations and profits. They also are broken down into components that point the finger to trouble spots which need immediate attention.

This new reporting system has been enthusiastically accepted by Conoco management as being a major aid in expansion, diversification, and long-range growth.

The problem . . . Need for a different technique of briefing management was underlined after McLean tackled the job.

L. F. McCollum, Continental president, handed him a pile of monthly reports. He asked McLean to study them and tell him what the significant developments were.

Here's McLean's account of what happened:

J. G. McLEAN
. . . His figures are revealing.

"After reading for 2 or 3 hours—and it took that long just to scan the pages—I stopped to make a rough estimate of the number of figures I was trying to look at and found it was somewhere in the neighborhood of 12,000!

"And then a little later on, to my horror, I found I was jotting down a list of additional figures I was going to need before I could give a good answer to Mr. McCollum's questions."

It pointed up McCollum's complaint that even though the company had improved the situation in recent years, it still lacked a "common denominator report." The goal was one which could be understood by all levels of management and at the same time give top executives a quick idea of the progress of all segments of the business.

So McLean, in cooperation with the controller, went to work in earnest. The new report represents the best ideas gleaned from executives of numerous other companies and from Conoco's own staff.

What's in the report . . . The system involves three different kinds of reports:

. . . Accounting reports.
. . . Special reports.
. . . Control reports.

Accounting reports contain the vital statistics. They're the basic records which are kept to comply with government regulations, to provide reports to stockholders, and to apprise management of facts needed in day-to-day administration of company affairs.

Special reports are based upon accounting data. But they are prepared only as the need arises. They deal with the causes and cures for particular ills.

Control reports are made up of selected accounting, financial, and operating data. As McLean explains:

"It might be said that control reports call attention to the situations which require special reports, and the accounting reports provide the basic data upon which both the special reports and control reports must rest."

The control reports are designed to call attention to short or long-run conditions which would bear special study.

Control report . . . This report is based on key data lifted from financial and accounting records to:

. . . Spotlight trends in the business, thus assisting in development of policies and programs.

. . . Provide basis for evaluating current performance against the previous year and aims in the coming year.

. . . Point up phases of operations which should be studied in detail.

A series of control reports is published quarterly in a book distributed to key personnel.

The book is divided into three sections—a series of company-wide summaries, reports for each major department, and reports for each of the six regions.

The company summaries contain balance-sheet data, net income, earnings in cash and per share, return on investment, net income by departments and regions, and budgeted expenses by departments and regions.

The department reports cover exploration and production, manufacturing and marketing (combined for profit reporting), petrochemicals, transportation and supplies, and miscellaneous.

The regional reports cover each functional department.

All reports follow a pattern. The figures tie together. And the total offers an integrated analysis of all operations. If trouble spots show up in company summaries, they may be analyzed immediately in terms of all components.

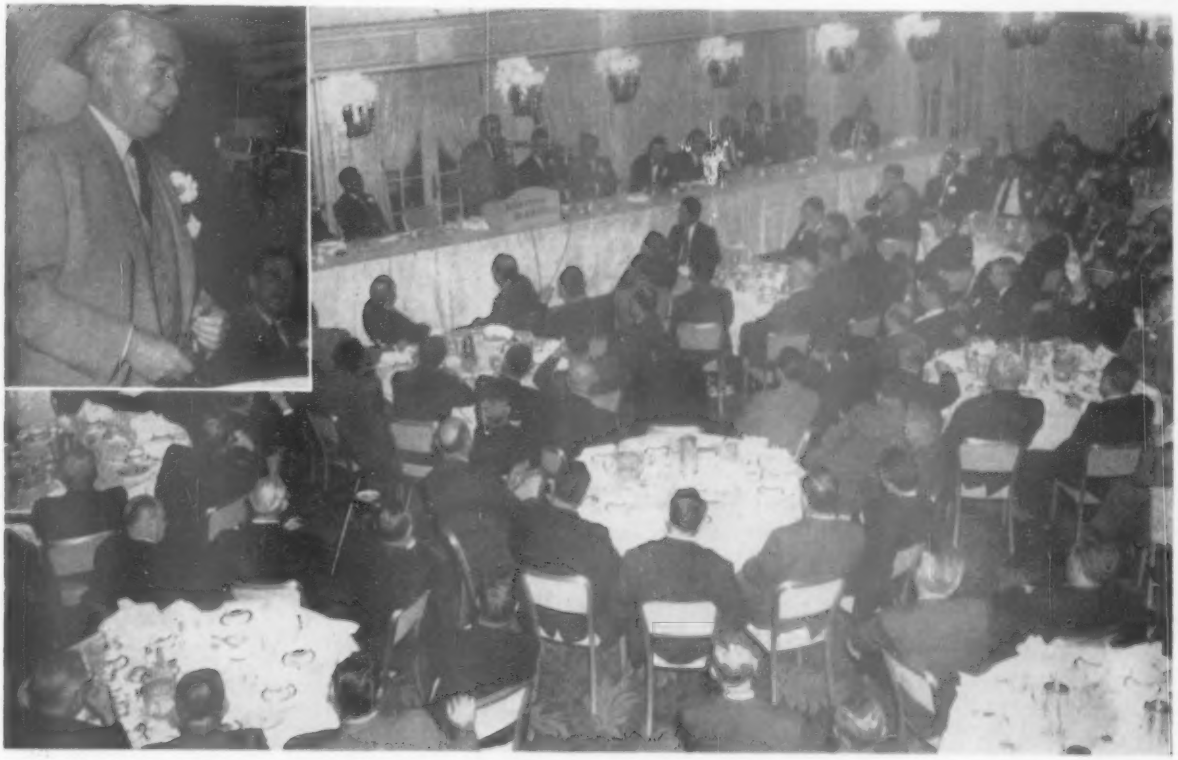
What reports show . . . Each report contains five types of information.

The first page shows trends over the past 5 or 6 years in a column of graphs.

A second column of graphs compares monthly results against the previous year.

A box contains a quarterly comparison of results.

Another box has a quarterly and cumulative comparison of actual results



J. B. O'CONNOR, president of Dresser Industries, Inc., Dallas, (inset) is shown as he spoke at the annual Nomads luncheon at the A.P.I. convention last week. This year's luncheon meeting was held Monday in the Sheraton-Blackstone Hotel.

against forecasts when projected figures have been made.

A summary analysis of what's behind any variation in results from the past year is the last feature of the reports.

With all basic types of information on a single page, the statistics can be observed in relationship to each other.

In following pages, the same types of information are shown for each major segment of the region. For each separate unit there is an analysis of net income, return on investment, sales volume, prices, and operating costs.

How reports are used . . . When books have been distributed, department managers at the company headquarters meet within a week and spend some 2 hours reviewing company-wide and departmental summaries.

Next comes a series of meetings with the regional management groups. These meetings usually include the president and executive vice president, administrative vice presidents for exploration, production, manufacturing, marketing, and transportation; the financial vice president; controller and McLean.

Reports are covered page by page. To kick off discussion, points of significance are highlighted by McLean or the controller. The headquarters group asks questions, and the way is open for comments and explanations by regional men. The books going to the president and executive president have notations made by the staff to direct their attention to points which need analysis.

Several regional managers, on their own initiative, hold similar quarterly review meetings with division superintendents reporting to them. What they do with the reports is up to them. In some cases they prepare more detailed reports, broken down into still smaller units, using the same format as the company-wide study.

Results . . . Continental sees four main benefits from these reports and meetings:

. . . Performance yardsticks are arrived at so that evaluation is made by the management group on the same basis for all operations.

Previous meetings have been stymied because different executives might be using different sets of figures, and such differences were stumbling blocks to effective study of a problem.

. . . Chronic problems are spotlighted. The reports show up areas where action must be taken to stem unfavorable profit trends.

. . . Staff-work burden is cut. With this system of reports, exhaustive studies which sometimes are touched off merely by a question from management are eliminated.

. . . Basis is laid for further growth. As expansion gives rise to more decentralization and autonomy of company units, management would work in the dark without good reports which permit a review of operating plans and progress.

Journal Editors at the A.P.I.

THE OIL AND GAS JOURNAL had a corps of seven editors in Chicago last week to cover all phases of the A.P.I. meeting.

Representing the Journal were K. B. Barnes, editor; C. O. Willson, consulting editor; Henry D. Ralph, chief editorial writer; Ted A. Armstrong, news editor; George Weber, refining editor; Paul Reed, pipeline editor; and Gene T. Kinney, assistant pipeline editor.

The Journal's Latin American affiliate, Petroleo Interamericano, was represented by Oscar B. Irizarry, publisher and editor.

Lesson from the Whiting Explosion

- First detailed report on disaster shows change needed in basic design and operation concepts

CHICAGO. — The refining industry has a safety lesson to learn from the Whiting disaster. It is this: The conventional approach to design and operation of process units needs a thorough review and some modification.

The violent explosion which destroyed the fluid hydroforming unit at the Standard Oil Co. (Ind.), refinery is throwing a new light on the detonation of hydrocarbon gases. It is revealing that:

. . . **Established concept** of pressure generation of explosive mixtures in lines and vessels falls far short of possibility.

. . . **Conventional pressure - relieving** devices are not enough.

. . . **Further precautions** are necessary.

Full findings of an engineering study on the Whiting detonation were revealed for the first time last week. J. C. Ducommun, Indiana Standard's general manager of manufacturing, outlined them for refiners attending the A.P.I. meeting.

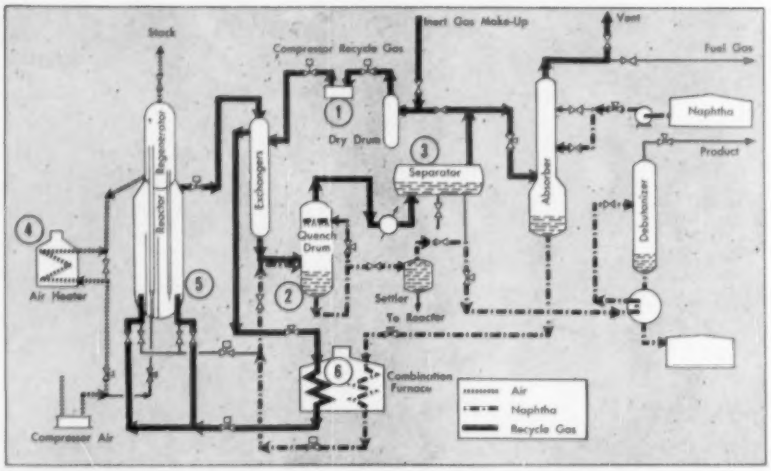
The upshot could be that Indiana's loss may prove instrumental in preventing further disasters of this magnitude in units processing hydrocarbons. It is significant that the lessons learned from this study apply generally to all systems handling hydrocarbons. Hence the need for an over-all review of safety precautions.

How it happened . . . It was early morning on August 27, 1955.

Operators at Whiting were bringing back on stream FHU-700, Indiana's identification for the fluid hydroformer. It had been brought down for a scheduled turnaround following several months of satisfactory operations. No catalyst was in the system.

With the aid of a schematic diagram of the unit (see chart). Ducommun explained step by step the events which led to the explosion.

"Inert gas from a conventional generator was used to purge and heat the recycle and oil side system. In the heating operation, circulation of the inert gas was maintained by the recycle gas compressor (1) in the circuit (heavy solid line). Recycle gas system pressure was controlled by the vent in the absorber overhead line.



HOW IT HAPPENED is indicated in this flow sheet. For an analysis of the events leading up to the unexpected blast, see text.

"During the heating operation it was necessary to circulate naphtha through the route shown by the dashed line. The route brought the liquid naphtha into contact with the circulating inert gas in two vessels—the high pressure quench drum (2) and the high pressure separator (3).

"This resulted in contamination of the inert gas with hydrocarbon vapors in amounts sufficient to satisfy the fuel requirement for a combustible mixture. Because of the common head between the reactor and the regenerator, it was necessary to heat the regenerator simultaneously with the reactor. This was done with air, (dotted line) heated in a surface furnace (4). Regenerator pressure was controlled by the regenerator vent.

"Isolation of the regenerator from the reactor should have been accomplished by a closure of the plug valves in the catalyst circulating lines (5). For unknown reasons, one or both of these valves failed to close, even though exterior inspection indicated they were closed. Air backed into the fuel-carrying recycle gas system through the open valve.

"Ignition occurred on the wall of a tube recycle gas section (6) of the combination furnace which at the time was perhaps at 600° F. All vessels in the recycle system suffered internal explosion except for the quench drum in which the atmosphere was hydrocarbon rich. Shock waves developed in two vessels, the reactor and the separator, fragmenting them extensively."

So violent was the detonation that the 2½-in. steel shell of the 600-ton reactor fragmented into 13 major pieces ranging from 3 to 136 tons. A 60-ton section flew 1,200 ft. The separator broke into 29 pieces, one of which was hurled 1,500 ft.

The reactor seemed to "peel apart," according to a witness. This was proved literally true by the reserve curvature found on some fragments.

What it shows . . . What conclusions can the industry draw? These, said Ducommun:

"As a result of the disastrous explosion of FHU-700, and the engineering study following that explosion, it has been found that a concept of pressure generation not generally known in the petroleum industry can be encountered in process equipment containing the right ingredients.

"It is quite well known that detonation was possible with hydrogen or acetylene, or with carbon monoxide gases under proper conditions in vessels or lines, regardless of size. The FHU-700 explosion further revealed the heretofore little realized fact that detonation can occur in large vessels with hydrocarbon gases—resulting in

fragmentation of a vessel constructed of alloy steel, 2½ in. thick, and hurling a 60-ton piece through the air a distance of 1,200 ft."

Detonation involves the development of violent shock waves. Engineers must have knowledge of both explosible limits and critical vessel dimensions. We know now that the pressure which may be generated in critically sized vessels as a result of detonation is many times that previously anticipated.

Hydrogen the trouble . . . In many new catalytic reforming and treating units, hydrogen predominates in the gases.

In such cases there can be dangerous mixtures of process-gas and air over a range of 1 to 75 per cent gas. In the older process units refiners dealt with hydrocarbons alone. They were explosive in cencentrations of 1 to 8 per cent.

Thus the potential explosive ranges in many processing units has increased some tenfold because of the presence of hydrogen.

What's needed . . . Obviously, the conventional approach used in the past is not capable of doing the job, said Ducommun.

Sufficient strength cannot be built into the equipment. Pressure-relieving devices do not react with sufficient reliability and speed.

The problem can only be answered by a realistic evaluation of the hazards as engineers now know them. This means adding adequate safety features and reliable, "foolproof" controls. The combination of fuel, oxygen and a source of ignition must be automatically prevented, except under rigorously controlled conditions.

"We must be willing, and we are willing," said Ducommun, "to spend thousands and sometimes hundreds of thousand of dollars to provide these safeguards. For catalyst regeneration, we must install additional oxygen analyzers to assure a rigorously controlled supply. Fuel and oxygen must be separated by the use of inert gas holders, dependable motor - operated double block valves. Additional valves for blind equivalents and seal-gas systems may also be used."

Other lessons . . . Refiners can learn plenty from other aspects of the Whiting disaster.

Considering the magnitude of the detonation it is remarkable that the damage was not much greater. Credit for this goes to careful emergency plans made and practiced through the years. These included:

. . . Fire-fighting is part of everyone's job at Whiting.

The major disaster alarm was a signal for all employes wherever they might be to report to the refinery for duty. They reported, performed according to plan, and won. Operators brought all refinery units down without mishap. It was humanly impossible to extinguish the fire which resulted.

. . . Fireproofing materials paid off handsomely.

Many lines of welded construction remained intact. Steel valves and pump casings resisted the heat while cast-iron valves and fittings disintegrated. Threaded and screwed pipe couplings separated.

. . . Emergency communications systems proved vital.

The refinery had about 36 cars and trucks equipped with two-way radio. They proved the only means of communication since existing telephone service went out immediately.

Ducommun credited employes and neighbors, both individual and industrial, for the successful control of the fire and the rapid rehabilitation of the refinery.

By September 10 the first crude runs were resumed on a small scale. Runs rapidly grew to 100,000 bbl. daily by the third week in September. By November 20, just 85 days after the fire, the refinery was back to its prefire level of over 200,000 bbl. daily.

D. L. CONNELLY

D. T. COLLEY

H. W. FERGUSON

A.P.I. Elects Three New Vice Presidents

CHICAGO. — The A.P.I. last week elected three new vice presidents and 17 new directors.

The new vice presidents are:

Production: D. L. Connelly, Houston, senior vice president and director of Warren Petroleum Corp.

Refining: H. W. Ferguson, Houston, vice president of Humble Oil & Refining Co.

Marketing: Dwight T. Colley, Philadelphia, vice president and general manager of marketing, Atlantic Refining Co.

The A.P.I. reelected Lacey Walker as secretary. Since Walker is retiring on March 1 (see page 137) the Institute named R. H. Stewart, of the A.P.I. staff, assistant secretary.

In addition to the 17 new directors, T. H. Barton, El Dorado, Ark., founder and chairman of Lion Oil Co., now a division of Monsanto Chemical Co., was elected an honorary member of the board.

The new directors are:

C. W. Barrett, The Texas Co., Houston; D. L. Connelly, Warren Petroleum Corp., Houston; Harry W. Ferguson, Humble Oil & Refining Co., Houston; Max Fisher, Aurora Gasoline Co., Detroit; J. W. Foley, The Texas Co., New York.

Harry J. Kennedy, Continental Oil Co., Houston; R. L. Kidd, Cities Service Oil Co., Bartlesville; J. F. Lynch, La Gloria Oil & Gas Co., Corpus Christi; C. H. Murphy, Jr., Murphy Corp., El Dorado, Ark.

Fred F. Murray, Oil Well Supply Co., Dallas; A. L. Nickerson, Socony Mobil Oil Co., Inc., New York; Ed Parkes, United Gas Pipe Line Co., Shreveport; A. C. Rubel, Union Oil Co. of California, Los Angeles.

E. L. Steiniger, Sinclair Oil Corp., New York; L. A. Sunkel, Atlantic Refining Co., Dallas; W. M. Vaughey, Vaughey & Vaughey, Jackson, Miss.; and R. Wagner, Chicago Corp., Chicago.

Several top officers of the Institute were reelected. They are Jake L. Hamon, Dallas, chairman of the board; Frank Porter, Oklahoma City, president; F. O. Prior, Standard Oil Co. (Ind.), Chicago, vice president for transportation; and B. Brewster Jennings, Socony Mobil Oil Co., Inc., New York, treasurer.

Speak Up, Oil Men Told

Time has come to put up or shut up on improving industry relations with public and government, Prior tells A.P.I.

CHICAGO.—Put up or shut up on the matter of bettering relations with the public and the Government, the oil industry was told by Frank O. Prior, president of Standard Oil Co. (Ind.).

Eight specific points for a better program were outlined by Prior to the closing general session of the A. P. I. meeting here.

In a vigorous call for aggressive action, Prior said Government is properly concerned with the oil industry and the industry must be properly concerned with the Government. His address bristled with such statements as:

"Government can take our business away from us faster than competitors can."

"We cannot and should not remain silent when our industry is subjected to vicious and irresponsible attacks calculated to undermine public confidence . . . These attacks must be answered forthwith."

"No longer can public relations and political affairs be considered an extra, like chrome on a car."

"We must not only tell the truth, we must sell the truth."

"Our opponents who favor a socialized and regimented society have worked harder than we have . . . We have lost ground in the political arena."

"We must develop and maintain the same flexibility in our industry public-relations program as we use in our daily individual operations."

Prior's eight specific points were:

1. Broaden the program in scope, with more effectiveness in short-range actions.

The public-relations program should encompass the entire industry.

For example, the natural-gas educational campaign should be resumed and carried through, and should also be aimed at undesirable features of numerous bills which will probably be presented in the next Congress.

2. Gear the program to give concentrated attention from time to time to special problems—local, state, and national.

3. Make effective use of the agencies available, such as coordinating the programs and efforts of O.I.I.C. and A.P.I.C.

4. Think and act aggressively.

"I said aggressively—not arrogantly. Too often when it came to public action we have just folded . . . You can't resist the encroachment of bureaucratic socialism by being nice to everybody . . . Appeasement doesn't work in this area any more than it does in world politics."

5. Determine to unite as an industry on issues where there is substantial agreement.

"We should not submit to tyranny by a minority . . . There are many questions upon which we have not taken united action because a small group of unrepresentative spokesmen have been allowed to make those subjects taboo.

"If a large majority of our industry favors a program, the A.P.I. should speak out . . . We cannot operate the A.P.I. like the United Nations with certain elements exercising the veto power."

6. Authority of the O.I.I.C. and the A.P.I.C. should be expanded so they can address themselves to specific situations promptly and vigorously. A flexible agency with proper staff can anticipate difficulties before they arise.

"The history of the gas fight should have taught us we did not have a lobby worthy of the name. The left-wing columnists keep talking about the 'tremendously powerful oil and gas lobby.' This is a joke.

"We improvised every step of the way. By comparison with others, we are unbelievably ineffective when it comes to influencing legislation . . . We are going to get the reputation for lobbying even if we sit on our hands and do nothing."

7. Keep well informed on what goes on in Washington affecting petroleum, and through the A.P.I. the voice of the industry should be heard on all important issues.

8. Oil-company leaders must speak out as individuals as well as through industry associations.

"There are times when industry-wide action is not enough. Something more is needed . . . The personal touch at the local level . . . The responsibility for fighting becomes an individual responsibility . . .

A MEDICAL AND HEALTH session heard an address by David T. Staples, extreme right, president of Tidewater Oil Co. From the left others at the head table are Leo Wade, Esso Standard Oil Co., New York; E. J. Cahill, California Research Corp., Richmond, Calif.; C. Richard Walmer, Mellon Institute, Pittsburgh; and L. E. Curtis, Standard Oil Co. of California, San Francisco.

A.P.I. Hears Forecast

Atlantic Refining economist says total demand will jump 4 per cent in '57, sees annual 3 per cent gain until '62

CHICAGO.—Total demand will increase by 4 per cent in 1957 and continue to rise after that at an annual average rate of 3 per cent until 1962.

That was the prediction made by E. T. Knight of Atlantic Refining Co. at the A.P.I. session on petroleum statistics here last week.

Knight said total requirements for petroleum and products in 1957 should reach 9,598,000 bbl. daily, an increase of 371,000 bbl. daily over 1956. This figure was based on 7 months actual demand and 5 months estimated.

His long-range forecast placed total demand in 1962 at 11,350,000 bbl. daily, an increase over the 1957 figure of 18.3 per cent. Total domestic demand would account for 11,100,000 bbl. daily of this, representing a boost of 20 per cent over 1957.

Domestic demand for motor fuel should be up at least 18 per cent in 1962, Knight declared, and distillate fuels should experience a 23.4 per cent rise. The upward trend is broken by exports, which will drop about 25 per cent by 1962. The drop will set the level at about 250,000 bbl. daily.

Knight also forecast that:

... **Total domestic demand** for next year will be up 4.1 per cent, climbing 366,000 bbl. daily to 9,265,000 bbl. daily.

... **Domestic gasoline demand** will jump 163,000 bbl. a day to 3,967,000 bbl. daily for a gain of 4.3 per cent. This is based on a 3 per cent increase in the number of trucks and buses using gasoline.

... **Diesel fuels** will be burned by 10 per cent more trucks and buses next year, pushing the demand for this product up 4.5 per cent. The increase will be 22,000 bbl. daily to bring the total to 513,000 bbl. daily.

... **Crude runs to still** will increase about 3.2 per cent in 1957 to 8,221,000 bbl. daily.

... **L.P.G.** will make one of the bigger jumps, an 8.7 per cent increase to 482,000 bbl. daily. Increasing requirements of the chemical industry and a growing direct use of the product as a motor fuel are contributing factors.

Other products ... If temperatures follow the normal pattern, use of kerosine will drop slightly and heating oils will show only a moderate gain, Knight said. The early months of 1956 were colder than normal, he explained, resulting in above-average usage.

Unless the cold cycle is repeated, kerosine usage should drop 1.7 per cent for a daily-average consumption of 325,000 bbl. Heating oils will be able to show an increase because there will be an estimated 5 per cent more heating units in operation.

The demand for residual fuels should increase by 1.3 per cent to bring domestic consumption to 1,575,000 bbl. daily during 1957. Industrial production may go up by 2 or 3 per cent, but competition could result in some consumers switching to other products. Heating requirements may just about hold their own. They might even drop slightly.

All other products should find a market for 1,113,000 bbl. daily for 1957, an increase of 81,000 bbl. daily. This is an 8.8 per cent jump.

Asphalt is expected to furnish much of the impetus for an increase in this category. With the federal road-building program shaping up, demand for this product should shoot up by 11.7 per cent.

Knight stressed that accuracy of any forecast hinges on the outcome of three controversial problems. He based his presentation on the assumption that:

... **Suez Canal** and Middle East troubles may extend into the early months of next year, but no marked change in the pattern of world movements of crude and petroleum products is in the making.

... **Stocks will continue** to climb, but at a slower pace than in 1956. The combined increase for 1957 will run 35,000 bbl. daily instead of the 126,000 recorded for this year.

... **Imports will continue** at the same average rates shown in the schedule of the Texas Railroad Commission for November and December of this year and January of 1957.

DOMESTIC DEMAND FOR DISTILLATES
1957
(Thousands of barrels daily)

		Increase over 1956	
Diesel fuels:	Quantity	Quantity	Per cent
Railroads	238	7	3.0
Trucks and buses	80	7	8.8
Miscellaneous	195	8	4.1
Total diesel	513	22	4.5
Other distillates:			
Heating oils	1,075	33	3.1
Miscellaneous	215	14	7.0
Total other	1,290	47	3.8
Total distillates	1,803	69	3.9

DEMAND FOR PETROLEUM PRODUCTS
Long-Term Forecast
(Thousands of barrels daily)

			Per cent increase
Domestic demand:	1957	1962	over 1957
Motor fuel	3,967	4,687	18.0
Kerosine	325	330	1.5
Distillate fuels	1,803	2,225	23.4
Residual fuels	1,575	1,625	3.2
L.P.G.	482	700	45.0
Other	1,113	1,533	25.0
Total domestic	9,265	11,100	20.0
Exports:			
Crude oil	30	25	—16.6
Products	303	225	—26.0
Total exports	333	250	—25.0
Total demand	9,598	11,350	18.3

SUPPLY AND DEMAND—PETROLEUM PRODUCTS
(Thousands of barrels daily)

			Per cent
Domestic demand	1956	1957	increase
Motor fuel	3,804	3,967	4.3
Kerosine	331	325	—1.7
Distillate fuels	1,734	1,803	3.9
Residual fuels	1,555	1,575	1.3
L.P.G.	443	482	8.7
Lubricants	121	122	0.8
Wax	12	12	
Jet fuel	186	218	17.0
Asphalt	242	271	11.7
Road oil	24	26	8.0
Other and loss	447	464	3.8
Total domestic demand	8,899	9,265	4.1
Exports			
Crude	29	30	3.5
Products	299	303	0.8
Total exports	328	333	1.3
Total demand	9,227	9,598	4.0
Stock change	126	35	
Required supply	9,353	9,633	3.0
Natural gasoline, etc.	786	830	5.6
Product imports	483	475	—1.8
Required crude oil	8,084	8,328	3.0
Crude imports	957	1,018	6.4
Crude production	7,127	7,310	2.6
Runs to stills	7,965	8,221	3.2

DOMESTIC DEMAND FOR GASOLINE
1957
(Thousands of barrels daily)

		Increase over 1956	
Classes of consumers—	Quantity	Quantity	Per cent
Passenger cars	2,443	113	4.8
Trucks	779	23	3.0
Buses	31		
Total automotive	3,253	136	4.4
Aviation	212	11	5.5
Industrial naphtha	69	2	3.0
Other (incl. Gov't.)	433	14	3.3
Total gasoline	3,967	163	4.3

Gonzales Sees Abundant U. S. Capacity

CHICAGO.—Domestic producers could add more than 2,000,000 bbl. of oil daily to current production in this country for at least 3 years. This would more than offset the loss of present imports.

With this conclusion, Dr. Richard J. Gonzales, director of Humble Oil & Refining Co., Houston, challenged the contention that this nation has no large reserves of available oil and must conserve its present supplies with continued increases in imports.

He spoke before the Committee on Petroleum Statistics at the A.P.I. meeting here last week, where much of the corridor talk centered around the Middle East crisis.

His subject, "Petroleum for Our Future Progress," had a direct bearing on the current oil situation in the Middle East, and on long-range national and international oil policy.

Imports ratio . . . Dr. Gonzales said the reserve position and the availability of crude oil in the United States have improved steadily since 1948. There is no reason to fear that this trend will change. The year 1948 was the last which domestic production approached the maximum efficient rate.

Regarding imports, Dr. Gonzales, who is director of the largest domestic producer of oil in the United States, supported the government plan which seeks to maintain the 1954 relationship between foreign and domestic oil supplies in this country.

This ratio is desirable from the standpoint of national defense and will encourage a sound operating position for domestic producers, he said.

His conclusions on crude-oil availability are based on these six points:

. . . Larger proportion of new wells. The proportion of new wells to all producers increased from 23 per cent in 1942-48, to 34 in 1949-55.

. . . More intensive development. Operators have stepped up development of proved reserves. In Texas, which accounts for half of the known oil in the United States, there are now 1.6 more producing wells per million barrels of reserves than there were in 1948.

. . . Rocky Mountain facilities. Eight years ago the Rocky Mountain area was limited by lack of adequate pipeline capacity to markets in the Middle West. In 1948, production in that area represented an annual rate equal to 7.4 per cent of proved reserves. Production this year reached a level equal to 9 per cent of proved reserves.

. . . Pressure maintenance and water flood. Significant developments have occurred in unitization projects since 1948, increasing both recoverable reserves and the rate at which these reserves can be produced on a sustained basis.

. . . Water-drive fields. In a number of major fields, more efficient water drives serve to sustain productive capacity over a long period. As a result, the rate at which remaining reserves can be depleted increases with time.

. . . Better techniques. In the past 8 years, improved fracturing and perforating methods have had striking results in stimulating production.

The contention of some that the best way to determine the potential of a well or field is to produce it at capacity for a time was attacked by Dr. Gonzales as "not only unnecessary but impractical in many cases . . .

"This suggestion underrates the knowledge of engineers and regulatory commissions about reservoir performance and overlooks some practical problems."

Long-range . . . Dr. Gonzales bases an optimistic long-range outlook on the past record of the industry.

Nothing in the past suggests any slowing down in the rate of discovery, this was exemplified in the table at left.

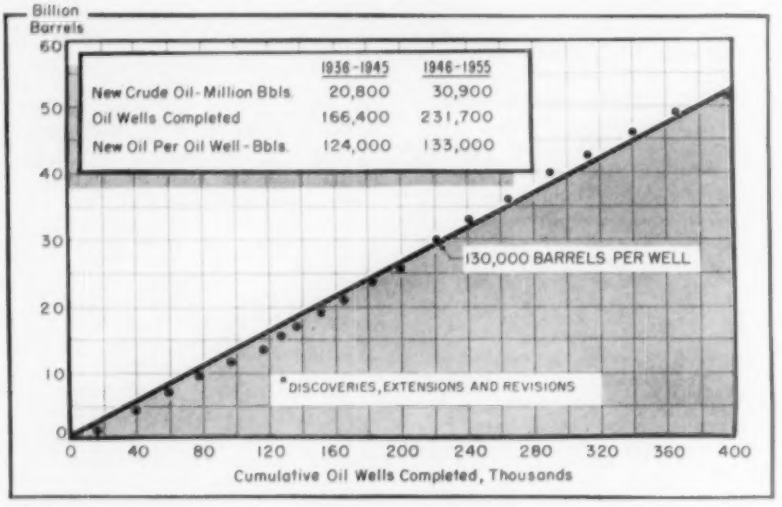
Dr. Gonzales cited these factors to substantiate his views on the future of the domestic industry:

. . . More than 40 billion barrels of new oil could be developed in the next decade, based on development during the 1936-55 period. It will be surprising if development the next 10 years does not exceed the 1955 rate.

. . . United States Geological Survey predicts discovery of oil and gas in sufficient quantities "for many years to come . . . if the future can be judged by the past." . . .

The USGS points out that "in the United States adequate production has been a direct function of economic incentive. Until the unpredictable date

Cumulative New Crude Oil* Has Kept Pace With Completions (1936-1955)



Development of New Crude Oil in the United States

	Billion barrels			Thousand wells drilled		Thousand bbl. of new crude oil per	
	Production	Additions to reserves	Total new crude oil	Total	Oil	Well (total)	Oil
1859-1925	8.7	4.5	13.2	702	524	19	25
1926-1935	8.9	8.5	17.4	220	127	79	137
1936-1945	13.9	6.9	20.8	280	166	74	124
1946-1955	20.8	10.1	30.9	435	232	71	133
Total	52.3	30.0	82.3	1,637	1,049		

at which that incentive fails to provide the needed supplies, there will be no convincing evidence that we have reached the limits of our ability . . ."

. . . **Department of Interior** estimates that a "total of 300 billion barrels of oil as the ultimate reserves of the United States and the adjoining continental shelves seems to be a reasonable figure."

Dr. Gonzales explained that this estimate is much higher than some recent estimates that the United States will ultimately produce only 150 to 200 billion barrels.

. . . **There is serious question,** Dr. Gonzales contends, as to validity of the assumption that there remains to be discovered only as much oil as has been found in the past.

He reminded the oil men that changing technology makes it difficult at this time to predict what the ultimate production of an area will be.

Asphalt Gets Boost

Road building is expected to double demand by 1964

CHICAGO.—The new federal highway program centering around construction of 41,000 miles of interstate highways and normal road building, will mean a yearly demand for petroleum asphalt of 100,000,000 bbl. by 1964. This is double the present demand.

This and other predictions regarding the significance of the greatly expanded highway construction programs were made by D. M. Keezer of McGraw-Hill Publishing Co., Inc., before the Division of Marketing at the annual meeting of the A.P.I.

The road-construction bill in this country for the next 13 years will total $102 billion, according to Keezer. This includes expanded funds for state, county, and city plans; other federal-state construction; and a minimum of $24.8 billion to be spent for the interstate system of 41,000 miles.

Broad effects . . . The impact of this mammoth construction will be felt in many ways in addition to the consumption of petroleum asphalts. The construction work alone will require a billion gallons of gasoline, lubricating oils, and other petroleum products.

Relative to gasoline and lubricating-oil demands, the new highways will not only tend to expand the number of motor vehicles but the consumption per unit will also increase, the speaker said. He predicted the number of motor vehicles will jump from the present 65 million to 92 million by 1971.

LACEY WALKER: The telephone is almost an appendage.

Walker Is Retiring—Somewhat

CHICAGO.—Lacey Walker, who has spent most of his life as a member of the A.P.I. staff, was reelected secretary again last week—but only for the first 59 days of 1957.

The veteran major domo of the Institute's conventions will become an annuitant on March 1. He'll lose his title and some of the detail of his job, but he's not leaving the A.P.I.—at least not just yet. He'll be around through 1957 as convention manager, handling arrangements as usual for the Division of Refining's midyear meeting and the 1957 convention of the A.P.I. here.

After that, Lacey isn't sure. He has a quarter-section farm near Washingtonville, N. Y., 60 miles from his Manhattan office, which has considerable appeal. But Lacey isn't sure he'd enjoy being completely away from the people of the oil industry.

Last week, though, retirement was something to think about in moments of leisure, and in the midst of the Institute's thirty-sixth annual meeting there was no leisure.

Before his term runs out officially Lacey, on January 15, will complete his thirty-sixth year with the Institute, which was an infant only 21 months old when he joined it in 1921.

At that time the A.P.I. had only two dozen employes, fewer than 1,000 members. Its first annual meeting in Washington in 1920 drew an attendance of only 420, and Walker's first, at St. Louis in 1921, attracted only 537.

Since then, the Institute has grown up. It now employs 350, last year saw membership break the 10,000-mark, and registered a record 6,477 oil men at its 1954 convention here.

And Lacey has been in the middle of all of this growth. He's been secretary more than 30 years, and until 2 years ago was also assistant treasurer and the man in charge of raising the Institute's budget. He's still responsible for membership.

Lacey is quietly modest about his A.P.I. career. But there's one thing that pleases him: While he knows hundreds upon hundreds of oil men, even more know him.

His duties have been a little lighter in the past couple of years, and he'll have fewer tasks in 1957. What about 1958? Nobody knows. Especially Lacey.

A.P.I. Meeting

Paying-Out Time Offshore

Prospects for big oil fields still bright in tidelands, but Cram warns it's time for operators to slash costs

CHICAGO.—The glamor stage is largely over for oil operations offshore. The making-it-pay stage is here—and has been for some time.

The outlook offshore, thus, is for plain hard work but with a payoff assured for more than just a few well-heeled and lucky early birds.

That is the appraisal of Ira H. Cram, senior vice president of Continental Oil Co., Houston, Tex., in an address before the group session of the A.P.I. Division of Production here last week. Continental is active offshore as a member of the C.A.T.C. Group in the Gulf of Mexico and the C.U.S.S. Group off California.

Cram declared the offshore industry "is in the position of the football team that has made a beautiful record of first downs in spite of the officials, but has not as yet won the game."

Record bright . . . The offshore area of Louisiana and Texas has been prime oil hunting grounds.

To date 168 new-field wildcat wells drilled on 118 prospects have discovered 36 oil and 33 gas fields. It means 41 per cent of the wildcats have produced—year in and year out the national batting average is a little more than 11 per cent. Almost 5 per cent of total wildcats offshore has resulted in oil fields good for 50 million barrels or better.

Cram pointed out that during 1947-55 each offshore well added to reserves almost nine times as many hydrocarbons as the average well drilled in the United States.

So far 1,045 development wells have been drilled, 26 per cent of them dry. They have resulted in cumulative production as of September 1 of:

. . . 97 million barrels of crude oil and condensate.

. . . 210 billion cubic feet of marketed natural gas.

Cram noted that August production of crude was slightly over 92,000 bbl. daily on reduced allowables with marketed natural gas averaging about 230 million cubic feet daily.

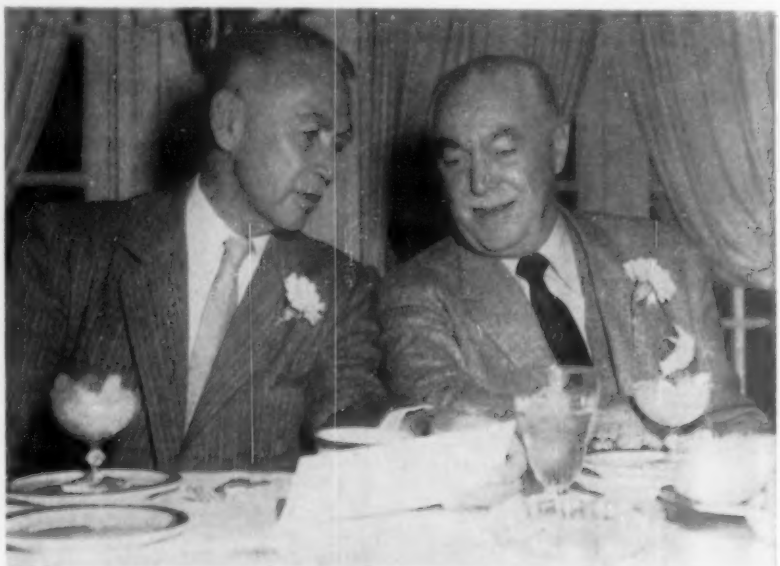
He estimated proved reserves at 620 million barrels of crude and condensate and a little more than 4 trillion cubic feet of natural gas. But he added: "It is entirely possible that discoveries to date ultimately will provide a reserve of 1¾ billion barrels of liquids and 14 trillion cubic feet of natural gas."

Heavy investment . . . All this activity has cost plenty of money—almost $1.6 billion to date—and the investment is still rising.

This outlay has bought 4.3 million acres of leases, almost 2,800 crew months of geophysical work and 10¾ million feet of drilling together with drilling equipment, producing and transportation facilities.

Income from production has been less than $250 million. Cram thus estimated that finding and developing expenditures have averaged $14 per barrel of crude produced. He predicted that, with the industry still spending daily more than it is taking in, an over-all payout is far from imminent.

Cost-cutting ahead . . . Offshore operators, according to Cram, have proved



RELAXING AT A NOMADS LUNCHEON are Sen. Antonio J. Bermudez, left, head of Petroleos Mexicanos, Mexico City, and J. B. O'Connor, president of Dresser Industries, Inc.

JOBBER ADVISORY COMMITTEE members heard a talk on percentage depletion by Lowell Stanley, Monterey Oil Co., consultant. Stanley, of Beverly Hills, uses a chart to illustrate a point.

they can find the fields, can drill in 112 ft. of water 64 miles from shore, can build underwater pipelines—all at a price.

"Each operator knows," he warned, "the task ahead now is to do everything more cheaply."

Statistics indicate the average offshore operator has comparatively low prospect-finding costs, reasonable acreage costs, and average drilling and equipping costs, Cram said. He outlined these costs as:

. . . **Geophysical** costs are about ¼ to ⅓ the average for onshore. Costs for finding an unleased structure that has a relatively good chance of being a giant field are cheap — about $150,000. Same costs onshore would exceed $1 million.

. . . **Leasing** has averaged $95 plus per acre—reasonable considering the quality of the prospects.

. . . **Drilling and equipping** wells have come high—but based on reserves per average offshore well they have been in line with average costs. The key is this: The average offshore well has found eight to nine times as many hydrocarbons as the average onshore well and has cost eight or nine times as much.

That speaks well for averages, but Cram observed the average offshore operator doesn't exist. Instead there are close to 50 individual operators with different financial capabilities, different costs and each interested only in his own costs. It is necessary that costs be reduced so that many operators, not just a fortunate few can make a profit offshore.

Where to cut . . . Cram pointed out a few areas most fertile for cost reduction. He said they chiefly involved:

. . . **Exploration.** Big fields must be found. A little field offshore may be a calamity to the small operator and too many of them would hurt a big operator. This means, Cram said, that "more exact economic appraisal of the geophysical anomalies and of the geologic data revealed by wildcat drilling is in order. It means harder work and harder thinking on the part of geologists and geophysicists."

. . . **Exploitation.** It's the same story offshore as onshore—a relentless drive to reduce costs of drilling, lifting, workovers, transportation, ad infinitum. But the opportunities are great, especially in cutting the excessive number of exploitation dry holes. Because of the cost of wells, it is prudent to proceed most cautiously in developing a field. Actually the pressure—because of desire for quicker payouts—is on the operator to develop rapidly and drill fewer dry holes at the same time.

WORKING SESSION at the A.P.I. meeting found this group of oil men interested in crude-oil measurements. This is typical of dozens of committee meetings held before and during the convention.

Unitization Aided by A.P.I. Forms

CHICAGO.—Development of A.P.I. model forms for unit agreements and unit operating agreements will greatly expedite recovery programs.

H. F. Beardmore, Warren Petroleum Corp., Houston, chairman of the A.P.I. subcommittee on unit agreements, reported the forms are available from the A.P.I. office in Dallas.

One titled "Unit Agreement" covers phases necessary for public record along with agreement articles which usually must be signed by royalty owners.

The other, called "Unit Operating Agreement," supplements the first. It is for working-interest owners and sets forth the operating terms.

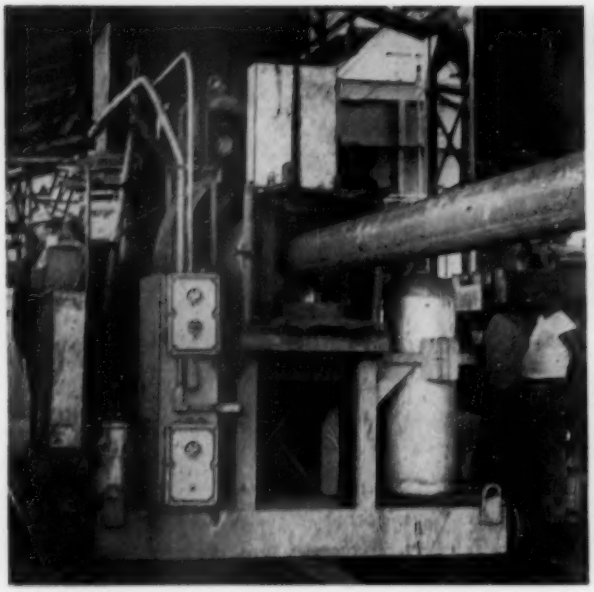
Beardmore noted that there are now more than 300 pool-wide units. About 30 new ones are being organized yearly, and the trend is increasing.

Time-saver . . . Many units now in operation were formed only after long periods of negotiation.

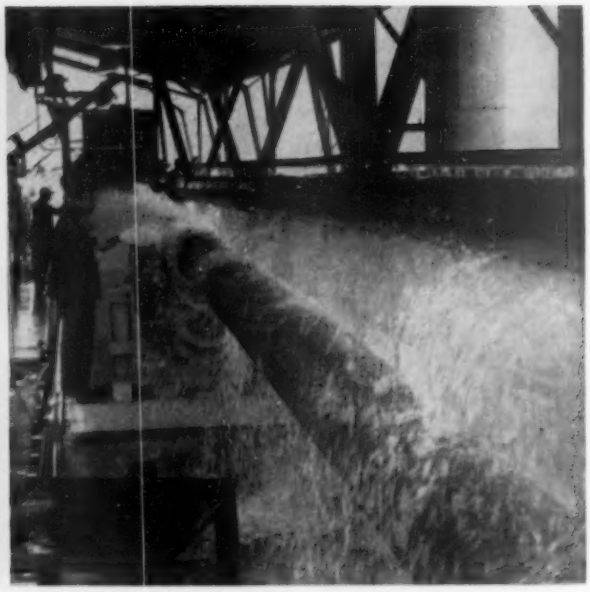
Such delay is costly to all parties, both in realization from the unit operation and in highly trained personnel which are tied up.

Experience has shown, Beardmore said, that a negotiating group, using a model form, can complete an agreement many months earlier than when starting from scratch.

SPEAKERS at a group of the Division of Transportation included, left to right, Dr. George P. Baker, president of the Transportation Association of America; H. G. Freas, Interstate Commerce Commission; and Franklin M. Kreml, director of the transportation center at Northwestern University.



Pipe is coated aboard barge . . .



Sprayed by overhead booms . . .

And immediately lowered into the marshes of southern Louisiana, as . . .

New Pipelining Process Is Put To Work

LAFITTE, La.—The new "Timcoat" process for over-water pipelining is out of the experimental stage.

Brown & Root, Inc., is taking the wraps off the new method at a 28-mile pipeline project for Southern Natural Gas Co. in the salt marshes south of New Orleans.

The new method extrudes a rubberized asphalt mastic weight coating directly onto the pipe, and may be the answer to many problems encountered in laying marine pipelines. The process was developed by Gen. P. H. Timothy, formerly with the U. S. Corps of Engineers.

The Timcoat asphalt mix consists of synthetic rubber and barite, fortified with glass fibers. It uses drilling mud, sand or limestone as a filler.

After the mix is applied hot, wrapped in fiber glass and water cooled, the pipe is immediately lowered into the ditch, or water, from an especially de-

signed lay barge, which includes mixing and heating vats. The extrusion machine and water cooler was constructed by Brown & Root.

The entire process includes a maze of controls and drives which are smoothly synchronized so that the entire operation will function with assembly-line precision:

1. Coating operation begins on a hopper barge, with an initial dry mixing of the barite, drilling mud, sand, limestone, and rubber components.

2. The dry mix, with desired proportion of components, is loaded onto another hopper barge which is used to shuttle back and forth to the lay barge.

3. The shuttle barge unloads into hoppers on the lay barge where dry mix is metered out. A conveyor belt dumps the dry mix into a hot mix machine where it comes in contact with emulsified asphalt. Mixing continues to take place as the asphalt and components travel through four sections of the hot mix machine.

4. Glass fibers are cut and added to the mix to add strength. Then the hot mix is dumped onto another conveyor belt and moved to the main feed storage hopper. This feeds the asphalt mix into the unit feed hoppers on the Timcoat machine.

This main hopper and those on the machine are all insulated and jacketed with hot oil lines to maintain the mix at the desired temperature of 260° F.

5. The pipe is welded conventionally, passed through a heater for raising its temperature slightly to improve the bond, wire-brushed, and then fed into the Timcoat machine. This unit rides on rails and is driven by an electric motor through a pinion gear and rack.

6. To begin its run, the machine is clamped to the bare side of the pipe and as the lay barge is moved forward it rides with the pipe to the end of the barge. The barge movement is stopped, the clamp released, and the machine started.

7. As it travels backwards, the asphalt mix enters the extrusion nozzle and emerges around the pipe as it passes through the machine. It is immediately wrapped in fiber glass and water sprayed.

The unit is spring mounted and electric vibrators are used to get the desired compaction of the mix on the pipe. This latter method was preferred over the use of direct pressure or impact.

The extrusion nozzle is similar to a swage and the mix is fed into the wide end by means of two screw conveyors and is packed down and extruded around the pipe.

The water spray is applied through means of an overhead telescoping boom made up of 2, 4, 6, and 8-in. perforated pipe. As the machine travels, this boom expands to spray the new coating in its entirety.

Once the machine reaches the end of its rails, the two feed hoppers are filled again from the main feed storage hopper.

Long-felt need . . . The current job in Louisiana includes about 27 miles of 12-in. and about ¾ mile of 8-in. The 12-in. line has a ⅞-in. wall thickness and the coating is 1 in. thick. Coating is applied at a rate between 15-20 ft. per minute.

According to Gen. Timothy the asphalt-mastic coating fills a long-felt need in marine pipelining *(The Oil and Gas Journal, January 2, page 70).* It can be applied at any desired density and will always result in a relatively thin coating and hence a greater negative buoyancy.

The process requires no curing time, as does concrete, and except for a few minutes under the water spray, can be immediately lowered into the marsh.

He's backed up further on this by Ed Minor, Brown & Root, Inc., vice president, who says the mix binds directly to the pipe metal so well that no primer is used. It can be laid continuously without the need for field joints as in the case with yard-coated concrete pipe.

Corrosion protection . . . An important property is its ductility. It doesn't chip or crack and will stay bonded to the pipe when it is lowered in the water. This flexibility is especially important when the water is deeper on offshore locations.

Finally, Minor says, the coating is absolutely water-proof and has 5-15 times the corrosion protection provided by the thickest coal-tar coating used.

California keeps oil stake in . . .

Checkerboard Offshore Leases

SACRAMENTO. — California is following a checkerboard pattern in putting up 62,000 acres of its potentially oil-rich tidelands for bonus-bid leasing.

This type of hedging is designed to give the state a stake in any offshore oil strikes.

Before submerged land is opened for bidding, the State Lands Commission must rule whether it is wildcat or development acreage. Wildcat acreage calls for a 12½ per cent royalty to the state. Development land, however, calls for a sliding royalty scale starting at 16⅔ per cent.

A discovery in any lease adjoining a block retained by the state thus would throw the state-held acreage into the higher classification when it comes up for bidding.

How it is done . . . The checkerboard pattern became apparent recently when 24,000 acres of offshore area was approved for leasing.

It represented what was left of an original request for 62,000 acres filed by the C.U.S.S. Group (Continental, Union, Shell and Superior) and Standard Oil Co. of California.

Surgery on the 62,000 acres worked like this:

. . . 14,000 acres lying between Coal Oil Point and Elwood off Santa Barbara County was eliminated from leasing now.

The decision was based on recommendation of the commission staff. It pointed out that certain drilling operations currently under way on offsetting acreage would provide valuable information on how to classify the 14,000 acres.

. . . 48,000 acres left then was sliced into 5,760-acre parcels. The area lies 3 miles offshore west of Elwood and consists of a 3-mile wide strip running to 1½ miles west of Point Conception.

The commission approved only every other 5,760-acre parcel for bonus-bid leasing after classifying it as wildcat acreage.

The decision to put up only alternate parcels was in line with a pattern the commission established last month on a 16,700-acre request filed by the C.U.S.S. Group on submerged lands off the Los Angeles - Ventura County line. At that time the commission agreed to put up only the center 5,600-acre tract.

Policy opposed . . . The commission's decision to continue a checkerboard policy in awarding offshore leases brought objections from the State Chamber of Commerce and the West Coast shipbuilding industry.

Speaking for the shipbuilders and shipyard trade unions, Louis Ets Hokin of San Francisco urged the commission to speed up tidelands leasing. He pointed out that the shipbuilding industry is counting heavily on the anticipated offshore oil boom for a much needed shot in the arm.

Oil Industry Shifts Gears in Crisis, Starts Supply Flowing Toward Europe

New patterns for doing business emerging as . . .

- ***Domestic buyers step up purchases. Foreign agents make some deals in scramble for oil on Gulf Coast.***
- ***States push up allowables. Washington also being pressured to help in emergency by coordinating oil movement and aiding in financing.***
- ***Pipelines are reported filling up already. Tankers converge on gulf, but will there be enough of them?***

Big problem for the oil industry: How long will it last?

SNARLED oil supply lines in the Middle East last week focused the world spotlight on:

. . . **The Gulf Coast,** richest storehouse of quickly available oil in the Western Hemisphere. Reaction here was quick. Buying picked up on the spot market. State officials moved to step up production. Domestic oil companies firmed up their crude buying policies. Tankers began converging on ports to move out the oil.

. . . **Washington,** where official government help may be needed to coordinate the oil movement to Europe and to finance purchases. Administration spokesmen expressed confidence that Western Europe's minimum requirements this winter will be met. But the crisis put the U.S. in a diplomatic dilemma.

Meanwhile, here's how the picture shaped up in other areas:

. . . **Suez Canal** is blocked for an extended period. Pipelines from Middle East oil fields either have been damaged or shut off from Britain and France *(The Oil and Gas Journal, November 12; page 122).*

. . . **Britain and France,** along with rest of Europe, face a critical oil shortage in coming months. Both nations, along with some smaller European countries, have instituted rationing and reduced pleasure driving to conserve crude inventories.

. . . **U.S. oil companies** with European refining affiliates began shifting crude supplies and tankers to get oil from America and Venezuela. This was accomplished on an individual company basis in a series of strictly private business deals.

. . . **Shipping** around the Cape of Good Hope ran into a snarl. Ships diverted from the Suez route began piling up at South African bunkering ports. Vessels were faced with as much as 8 days waiting time to take on bunker fuel because facilities to fuel ships were swamped.

The Gulf Coast

British and French purchasing agents managed to make some crude purchases on the Gulf Coast during the week. But they were buying far less oil than their refiners will need to fill the two-million-barrel-plus daily gap caused by loss of Suez.

Shell Oil Co. arranged to sell about 1,200,000 bbl. of Texas and Louisiana crude for shipment to Europe this month and next. Crude will be delivered to Asiatic Petroleum Co. at Gulf ports. Its destination in Europe was not disclosed.

A Shell spokesman said the sale will involve 11 T-2 tanker cargoes. Included in the transaction were 850,000 bbl. of West Texas crude which will be loaded at Houston and Corpus Christi. Remainder is expected to come from Louisiana fields.

Secrecy cloaks deals . . . Because of the competitive nature of the purchases, no one was admitting just how much he had bought or where.

Several international oil companies indicated, however, they were selling no crude to Europe pending clarification of the stand of the U.S. State Department. Others were taking care of the needs of their foreign affiliates first before selling.

The Texas Co. declined to confirm reports it was seeking pipeline transportation to move an additional 900,000 bbl. of crude from West Texas to the gulf.

A Gulf Oil Corp. spokesman said his company definitely was not selling crude to European markets.

One upshot of the pressure for crude was a strengthening of the heavy fuel market. Price for No. 6 heavy fuel rose 25 cents on the gulf from $2.10 to $2.35 per barrel.

Another result was an increase in shipping activities. Authorities said they expect at least 30 tankers diverted from the Middle East-Europe run to arrive at Gulf Coast ports this week to take on crude.

Buying stepped up . . . At least three big companies changed their purchasing policies during the week. Involved were Phillips, Humble and Gulf.

Phillips announced that it will end a 25 per cent reduction in normal purchases it began October 1 in Texas, Oklahoma, Kansas, and New Mexico. Phillips had cut its crude buying to 75 per cent of August purchases because of shortages in storage space. Phillips executives said that demand for addi-

TANKER REMOVED FROM MOTHBALL fleet is undergoing repairs at a Houston shipyard. It is one of 18 World War II ships being readied for service because of Middle East crisis.

tional crude has been created by international developments.

Humble announced that it would increase purchases of crude by 10,000 bbl. daily in 11 West Texas oil fields where Phillips also buys.

Gulf also returned to normal buying in Oklahoma, increasing its purchases by about 5,000 bbl. daily. The company previously had limited its take in Oklahoma.

Production going up . . . State conservation officials moved to meet the crisis by easing controls over oil production.

Louisiana became the first major oil-producing state in the region to raise its allowable specifically as a result of the Middle East shortage.

State Conservation Commissioner John B. Hussey ordered an immediate increase of 75,000 bbl. per day for the remainder of November. He announced the December allowable will be up an additional 25,000 bbl. daily. The first increase, authorized by emergency order, became effective November 12.

Hussey indicated, however, none of the extra crude output is expected to go to European markets. He said big refineries along the eastern seaboard are seeking a daily increase of 105,000 bbl. of Louisiana crude to replace their supplies cut off from the Middle East.

Most of Louisiana's increased crude production is expected to go to Esso Standard Oil Co. and Shell Oil Co. Other East Coast refiners said to be asking for more crude in Louisiana are Sun Oil Co. and California Oil Co.

The November allowable, before last week's increase, was 734,888 bbl. daily The new allowable of 809,888 bbl. daily is the highest in history for Louisiana. In December the state is expected to produce about 835,000 bbl. daily for another record. Highest allowable previously ordered was 788,778 bbl. daily last April.

Others follow suit . . . Only 2 days after Louisiana's action, New Mexico announced its December allowable would be increased slightly.

The New Mexico Oil Conservation Commission approved a 40-bbl. daily limit for each production unit in December. This compared with a 39-bbl. daily allowable for November. December state-wide daily production was set at 293,952 bbl.

Texas later ordered a 16-day producing schedule for December which will boost the state's daily allowable to 3,442,952 bbl. This is a gain of 128,562 bbl. daily over the initial allowable for November and 75,503 bbl. daily over the allowable on November 10.

Some purchasing companies asked the Texas Railroad Commission to retain the 15-day schedule set in November. Two others—Humble and Magnolia—asked that a split schedule be put into effect immediately. They proposed a 19-day plan the rest of November for all of Texas except West Texas where 15 days would be retained. In December they asked for 19 producing days for the rest of the state and 17 in West Texas.

How Much Oil

The big debate last week in oil circles remained just how much extra crude can be moved out of the Gulf Coast.

Executives attending the A.P.I. gathering in Chicago reported some recent company studies on this matter indicated that tanker loading facilities along the entire coast could handle only about 500,000 bbl. daily additional. That could be achieved by using everything available and scheduling tankers tightly at docks with little storage.

The same sources reported the studies also showed that almost 700,000 bbl. daily extra could be moved to the coast from inland fields. This could be achieved through existing pipelines but would involve some costly reroutings.

For example, it would mean routing West Texas crude through Oklahoma to the Mississippi River and barging down to tanker docks. It would cost 28 cents a barrel additional in freight. One company official said his firm didn't want to do this—he wasn't running a charitable organization.

Pipelines tight . . . The pipeline outlook in the southwest has tightened up considerably since Suez was closed and there are indications normal capacity has been reached.

Authorities report that pipelines from Texas, Oklahoma, and New Mexico to the Gulf Coast have committed for about 200,000 bbl. daily additional crude since the crisis arose. This is just about all the lines can handle without reconditioning old pump stations or making costly and impractical reroutings and interconnections. This could not be put into effect without government orders, subsidies, and steel priorities. And these are unlikely except in event of a dire emergency.

This is pointed up by the situation in West Texas-New Mexico lines. It was reported at the first of the week these lines could handle only 75,000 bbl. daily additional crude above current throughput. Later in the week this extra capacity was reported committed.

This means that parts of West Texas and New Mexico may not share in any increased state allowables. The addi-

tional pipeline capacity was made up from production under existing allowables.

Glut on market . . . Many crude buyers fear local pride in the oil states and need for state revenue may lead authorities to boost allowables above transportation capacity.

This would create distress crude in some places even worse than before the crisis. The buyers expressed hope that state officials will boost allowables only on basis of definite purchaser nominations for the amount of the increase.

Pipeline plans . . . At least one new pipeline may result from the present turmoil.

Pipeline executives took advantage of the Chicago A.P.I. meeting to plan a West Texas-Gulf Coast project called Industry Pipe Line. It would be a 26-in. line sponsored by major producers. Other meetings have been scheduled later to chart next steps.

Big drawback to such a project is shortage of steel. It's reported no pipe would be available for such a new line until 1960. This also would forestall any possible plans for immediate looping to increase capacity of present lines in Texas.

The steel supply outlook, however, assumes no government intervention. If the crisis warranted government action, pipe could be diverted to such a project.

In this connection, pipeline officials reported that two new major pipelines from Middle East producing countries to the Mediterranean are still very much alert.

Under considerations are lines from:

. . . Iraq through Turkey. Survey for this line is complete.

. . . The head of the Persian Gulf through Iraq and Turkey.

Washington's Dilemma

Probably the most ticklish job in the entire oil crisis is faced by U. S. officials in Washington.

Its diplomatic dilemma is this: If it gives way to Anglo-French pressure for help with oil, it is open to accusations of helping two nations it condemned before the United Nations for aggression. On the other hand, it has definite commitments to help Western Europe.

Indications in Washington are that the U. S. will stand firm and not officially offer Britain and France oil help until their forces are withdrawn from Egypt.

One government official reported this country is ready to help meet Europe's oil crisis but not to the extent of filling the entire supply loss.

If there is no further cut of supplies from the Middle East, the best that Europe can hope for is a shortage of 500,000 bbl. daily until the Suez and pipeline movements are resumed.

What's ahead . . . England and France are asking the United States to reactivate the Middle East Emergency Committee.

This group of representatives from 13 U. S. oil companies with foreign interests, was preparing to supply Europe with oil in event the Suez Canal was closed by Egypt. Its work was halted when Britain and France moved in and has been at a standstill for the past 3 weeks.

The committee is expected to be called back into action within a matter of days. Basic plans for the relief of Europe have been laid. They probably will be put into effect when the United Nations' police force takes over in Egypt. Then the U. S. can act without appearing to take sides.

Major points of the program include increased production in southwestern fields, setting up a pipeline network to move oil to tidewater, and pooling tankers to get the oil to Europe.

What about money? . . . Whether the U. S. still is willing to give Britain and France financial aid to buy dollar oil, and if so how much and in what way has not been disclosed.

The British-French military action precipitated the crisis and angered President Eisenhower. There is some feeling in Washington that in the circumstances American money should not be used to bail them out. On the other hand, the two countries have commitments in NATO and elsewhere which are vital to the U. S. They will emphasize they cannot carry out the pledges unless they get oil.

Washington officials claim the plan to provide oil for Europe presents no difficulty so far as increasing domestic production is concerned. The necessary pipeline transportation to the gulf can be arranged, they say, but tanker movement is the big problem.

Shipping headache . . . A new spotting of tankers scattered all over the world will be necessary before a tanker pool can be set up.

A month ago, the M.E.E.C. knew where all the tankers were but it has lost track of them during its suspension.

Some of the urgency has been taken out of planning by the fairly extensive crude stocks on hand in Europe when the crisis erupted. This has been bolstered by other crude shipments en route and by quick rationing of consumers. Officials believe Europe can get along for 6 weeks or more. By then a substantial transatlantic tanker service can be set up.

Meanwhile, the Navy is breaking out another 13 tankers from moth balls to relieve the increasing pressure on cargo space. The vessels will be overhauled and will go into point-to-point military cargo runs about the first of the year.

The Navy last month took eight T-2's out of the reserve fleet for emergency use. The first of these is expected to be ready for sea about December 1. The reserve vessels may permit release of more than 2,500,000 bbl. of merchant tanker space.

Imports shelved . . . The current crisis at least has ushered the thorny problem of foreign imports out of the picture for the time being.

Domestic producers, however, are determined the issue shall not be shelved because of what may be a short-term lightening of oil imports. They have advised Mobilization Director Flemming they will continue to fight for restrictions.

More than 40 importers filed their 1957 schedules before the November 8 deadline. But several emphasized their figures were uncertain and could not be realized if Middle East transportation routes continue blocked.

Because of the lack of definite figures, it is expected that Flemming will delay the decision he promised by December 1 on whether imports threaten national security.

Shadow of Russia . . . One aspect of the trouble especially worries Washington officials. The shadow of the Russian Communist Bear over the Middle East.

The British-French-Israeli stab into Egypt was stalled more by Russian threats of "volunteer" intervention than by a United Nations' demand for a cease fire.

This exposed for all time the extreme vulnerability of Western Europe's life line to an oil supply. If the Russians ever had any doubt about their easiest way to cripple Western Europe economically, Egypt and her Arab allies showed the way by blocking Suez and cutting the pipelines.

Harry Sinclair Dies

Near-legendary genius of oil had been retired 2½ years; career one of most controversial, fabled in the industry

OIL'S stormy petrel is dead.

Harry Ford Sinclair, onetime supercharged baron of the petroleum industry, died November 10 in Pasadena, Calif., where he had lived since taking his final step toward retirement 2½ years ago. He was 80.

Few men have been able to match the glittering success that was Sinclair's. In step with the character of his time, he switched from small-town druggist in Independence, Kans., to oil hunter at the age of 25.

He made his first big gain the same year, in 1901, and was on his way to the fame which comes with doing things bigger than anybody else is doing them. And that was Sinclair's indelible mark. He did everything big.

He put together one of the great empires of the petroleum industry and demonstrated that his ability for organization and administration was every bit as deft as his almost uncanny faculty for finding oil.

Sinclair never experienced a significant business failure. Eight years after his 1901 strike he was a millionaire—in an era and at an age when millionares were extremely rare.

Seven years after that, he formed the company which bears his name. When he retired, the fully integrated organization, formed as a $51,000,000 company, was valued at $1,200,000,000.

Sinclair was a member of the first board of directors of the American Petroleum Institute, which numbered about 40. His death cuts to three the number still living. They are Walter Teagle, former president of Standard Oil Co. (N. J.); Sam Messer, chairman of Quaker State Oil & Refining Co.; and J. Howard Pew, former chairman of Sun Oil Co.

Ride on a rocket . . . From the moment of Sinclair's initial success in oil he pushed on to build a bigger and bigger company.

But his rapid move to the top wasn't a waltz—it was more like a rough-shod ride on a skyrocket. His was the kind of career that makes biographers "pull out all the stops" and reach for ringing superlatives like spectacular, fabulous, bold, and dynamic.

No doubt, there are those who would use a different vocabulary — enemies are easy to come by for a turbulent figure in a turbulent era such as the one in which he came up the ladder. And right or wrong, he had his share of enemies, and perhaps more. He seldom smiled, almost never laughed, and always drove a hard bargain. But he also had friends and a big group of staunch supporters.

HARRY F. SINCLAIR from a painting which hangs in Sinclair Oil Corp.'s board of directors' room.

Ths set of circumstances made Sinclair one of the most controversial and storied men in the industry. Fact and fantasy, both good and bad, blend inseparably into the pattern of his brilliant career. Together, they probably present a pretty good picture of the man as he was.

A BIG STEP in the growth of the Sinclair organization came when Harry Sinclair, right, purchased Prairie Pipe Line Co. and Prairie Oil & Gas Co. from W. S. Fitzpatrick in 1932. The two are shown at Independence, Kans., at time of the consolidation.

No mention of Sinclair is complete without reference to the Teapot Dome episode.

Sinclair was acquitted of charges of fraud and bribery in obtaining the government-reserve lands in Wyoming in 1922. But he was given a 6-month sentence for contempt of court, after hiring private detectives to "shadow" members of the jury, and a 3-month sentence, to run concurrently, for contempt of the Senate. The latter charge was based on his refusal to answer a question from the Senate.

The beginnings . . . Sinclair was born July 6, 1876, at Wheeling, W. Va. He grew up in Independence, Kans., and was graduated from the University of Kansas in 1898, returning to Independence as a pharmacist. Three years later he became a partner in his first drilling venture, near Kiowa, Okla.

In 1909, he moved to Tulsa where a year later he formed the Exchange National Bank, known generally as "Harry Sinclair's bank." A partnership with the late Pat White during those years formed the real beginnings of Sinclair's oil empire, which was consolidated into a single organization in 1916, after the White-Sinclair partnership had been dissolved.

Other companies were formed from time to time, with further consolidations following. The firm became Sinclair Oil Corp. in 1943.

When Sinclair first moved toward consolidation, he went to New York and successfully pioneered in oil investments. In 1937, he further demonstrated his ability for organization.

Richfield Oil Co. of California was failing. Several leading business men had attempted to save it without success until Sinclair stepped in as chairman. He reorganized the firm into the present Richfield Oil Corp., combining the company's assets with those of Rio Grande Oil Co. in 1937.

Under Sinclair's guidance, it rapidly grew into a powerful firm, with assets climbing from $88,000,000 to more than $300,000,000 at the end of 1955. The Sinclair organization still holds a substantial interest in Richfield.

In 1949, after more than half a century in the petroleum business, Sinclair retired as president of the organization he had built into one of the largest in the world. In May 1954 he stepped down from the board.

Harry Sinclair is dead. But the reputation he won as the near-legendary genius of oil will not die with him. His name is indelibly carved on the roles of the industry's immortals.

Tanker Deals Brew

Maritime Administration studying proposals for 31 big, fast vessels, including 20 for American flag operation

WASHINGTON.—Deals for building 31 new tankers totaling nearly 1,500,000 deadweight tons are under study in the Maritime Administration, it was disclosed last week.

The new ships, estimated to cost $390,000,000, would be built in U. S. shipyards. These would be in addition to the 23 tankers totaling 790,000 tons now under construction at a cost of $223,000,000, Maritime Administrator Clarence G. Morse said.

Eighteen companies have proposals pending for new tanker construction under the Maritime Administration's build-and-transfer program.

Twenty of the new ships would be for American flag operation. Eleven others would be built for foreign registry and three now building also would be completed for foreign flag.

As an offset, the companies would be allowed to transfer some 55 war-built ships, both tanker and cargo vessels, to foreign flag.

These proposals would give the American Merchant Marine large, fast, new tankers in exchange for old, slow tonnage, Morse pointed out. But all of the vessels transferred would remain available to the U. S. in case of emergency, he emphasized.

100,000 tonners . . . The list of proposals laid before the Maritime Administration is topped by three 100,000-ton tankers. A dozen others would be of 45,000 tons or better.

None would have a speed of less than 16.5 knots and most of them would be even faster, ranging in one case as high as 18.75 knots.

While the Maritime Administration is successfully encouraging tanker construction, the Military Sea Transportation Service has called quits on its efforts to get 15 supertankers built by private interests for long-term charter to the Government.

Three tries at working out contracts for the vessels failed because the companies and the Government could not get together initially on the conditions for building and financing, and more recently because the ceiling of $5 per ton set as the charter price in 1954 is not realistic under today's conditions.

The MSTS has four government-financed tankers under construction as part of this program. But if the build-for-charter deal is to go through, Congress will have to ease the conditions, it is indicated.

What is planned . . . Proposals for new tankers now before the Maritime Administration came from:

U. S. Petroleum Carriers, one 100,-500-tonner, one to three of 46,000 tons, and two to four of 32,650 tons; N. Y. Tankers Co., Inc., and Industry Tankers Co., Inc., one 65,000 tons and one 32,650 tons; Ocean Transportation Co., one 35,000.

J. M. Carras, Inc., one 46,000; Socony Mobil Oil Co., Inc., one 29,000; Hess, Inc., and Hess Tankship Co., one 30,000-32,000; American Tramp Shipping Development Corp., one 35,000; American Foreign SS Corp., one 32,-000; Samuel Want, one 32,600; Peninsular Navigation Corp., one 32,600; Pan Oceanic Navigation, one 32,600; Webb & Knapp, one 32,600, and Atlantic Refining Co., two 30,000. All are for U. S. registry.

For foreign flag: Ocean Tanker Line, Ltd., one 41,000; Texas Co. (Panama), one 42,000; Barracuda Tanker Corp., three of 60,000; Onassis, two of 100,-000 and one 46,000; and Somerset Co., three of 45,500 tons.

Wage Policy Tested

Government says oil scouts should go on 40-hour week

TULSA.—Oil scouts may go on a 40-hour week with time and one-half for any overtime worked if the federal Government wins a suit filed here last week.

A test case was filed in U. S. District Court against Midstates Oil Corp. of Tulsa by the Department of Labor. The petition merely alleged that Midstates has violated provisions of the Wage Hour Law in failing to pay certain employes overtime for work beyond 40 hours. The issue, however, involves oil scouts and effects the entire oil industry.

Midstates officials said the suit arose from a routine check of its records by Department of Labor examiners. The company explained that along with others in the oil industry it has classified its scouts as administrative or executive employes and thus exempt from the 40-hour requirement of the law.

Government examiners, however, disagreed on the classification and instituted the court suit to settle the disagreement. The case in effect makes Midstates the guinea pig for a decision which will affect employe practices of the entire oil industry.

Oil scouts, by the nature of their work, often are forced to work irregular hours. Their schedules depend on drilling and leasing activity in their assigned areas. For this reason and because of their relation to management, most companies have considered them exempt.

A.P.I. Makes Its First L.P.G., L.R.G. Report

STOCKS of L.P.G. and L.R.G. now are reported on a semimonthly basis by the statistics department of the American Petroleum Institute.

A summary of the first report is shown in the table below. The full report furnishes an inventory breakdown for propane, butane, and mixtures by important storage districts.

The report also separates stocks of L.P.G. from L.R.G. and covers total storage at plants, terminals and underground.

District and product totals in the table are made up from company reports and estimates for nonreporting companies to put all figures on the same basis as stocks reported monthly by the Bureau of Mines.

Stocks of Gas Liquids

(1,000 gal.—as of Oct. 31)

Plants, terminals, and underground—	L.P.G.	L.R.G.
Atlantic Coast	10,801	3,535
Illinois, Indiana, Kentucky	35,142	4,592
Mid-Continent	72,427	4,235
E. Texas, Arkansas and N. Louisiana	126,216	450
Gulf Coast	99,175	10,383
West Texas, New Mexico	338,889	322
Rocky Mountain	7,815	313
Pacific Coast	1,878	32,458
Total	692,343	56,288

Navajos Hold Second Sale

WINDOW ROCK, Ariz.—The Navajo Indian tribe took in $3,247,095 last week at its second sale this month of oil and gas leases on tribal lands.

Bids were accepted on 82,200 acres making up 32 tracts in San Juan County, New Mexico. Earlier in the month, the tribe collected a record $27,400,000 in bids for leases on 112,130 acres.

It will hold a third sale November 23. All proceeds from the sales are deposited to the Navajo tribal fund.

High bidder at the most recent sale was Stanolind Oil & Gas Co., which paid bonuses totaling $1,955,595 for leases on 35,360 acres. Stanolind also made the high single bid of $532,403 for a 2,560-acre tract.

Jefferson Expanding

Petrochem firm adding new products, upping capacity

PORT NECHES, Tex.—Jefferson Chemical Co. has launched its biggest petrochemical expansion program since the company was founded in 1944.

The firm will increase production capacity for existing products and add several new ones—propylene oxide, propylene glycol, and other propylene derivatives. The buildup will:

. . . **Triple ethylene production** facilities.

. . . **Double ethylene glycol** capacity.

. . . **Boost ethylene oxide** production by 50 per cent through installation of a direct-oxidation unit. Chlorohydrination equipment will also continue to produce ethylene oxide.

The plant now has an annual capacity to produce about 90,000,000 lb. of ethylene, 63,000,000 lb. of ethylene glycol, and 110,000,000 lb. of ethylene oxide.

Jefferson also will construct a chlorine plant to supply material for other manufacturing processes. Most of the caustic soda will be marketed, while the company will use the hydrogen.

Stepped-up output of other chemicals is included in the expansion plans. Among these are specialty amines such as morphaline, an emulsifier for rubless waxes and polishes, and ethylene oxide specialties.

Jefferson Chemical is jointly owned by American Cyanamid Co. and The Texas Co. Feed stock for the plant comes from The Texas Co. refinery at Port Arthur, about 5 miles away.

Accidents "Stamped" Out?

SANTA FE, N. M.—The trading-stamp craze has taken a new twist.

Rutledge Drilling Co. is giving its drilling crews a chance to cash in on a merchandise-redemption plan of its own. The firm is not reviving the old "company store." And there's nothing to buy. But employes who qualify can select from a long list of catalogued articles designed to please the entire family. They simply collect their "stamps" and trade them in just like millions of housewives are doing every day.

The key to the plan is caution. Any member of a drilling crew who goes through 100 straight days without a lost-time accident gets 100 points, which he can use as stamps. If he suffers an accident, a new 100-day period starts immediately. Drillers receive double points when their entire crews achieve an accident-free period.

watching WASHINGTON

. . . with Bertram F. Linz

Death, retirement, and defeat . . .

THE oil industry has lost nearly one-seventh of its supporters who pushed the Harris bill through the House last year.

Death, retirement, and political defeat have taken 31 of the 209 congressmen who voted for the bill July 28, 1955. Since the bill passed by a margin of only six votes the industry had been hopeful that as many of them as possible would stay in Congress to help the bill next year.

There probably was no connection in most instances, but half of the men defeated were supporters of the bill.

The election, however, left gas legislation with a good springboard from which to start next year. Oren Harris of Arkansas, who sponsored the measure and pushed it through the House commerce committee, was reelected and will head the committee in the coming Congress. And on the other side of the Capitol, Warren G. Magnuson of Washington will continue to head the corresponding committee.

A long look at depletion . . .

THE first challenge of the new Congress to the oil and gas industry's 27½ per cent depletion allowance will come in the near future.

Several subdivisions of the House ways and means committee are studying various parts of the tax law in advance of the session.

One group opened its hearings last week. Another, under Rep. Wilbur Mills of Arkansas, will start shortly.

The Mills subcommittee is the one to watch. It is making a study of "loopholes" through which, it is charged, the Treasury loses millions of dollars a year. Mills plans to take a long look at percentage depletion as applied to oil and gas. He also may go into the question of revenue losses through accelerated depreciation.

Mills may make an effort to smoke out Treasury views on depletion. So far Secretary Humphrey has avoided any disclosure of his views of whether 27½ per cent is higher than needed as an incentive. But he has supported the claim that depletion is necessary if the natural resources industries are to continue their search for new reserves.

If foreign supplies were cut off . . .

CONGRESSIONAL committees may take a new look at national oil policy next year.

The Egyptian situation has made actual what so far had been the theoretical question of what would happen if Middle East oil supplies were cut. Military planning for possible wars of various types and under varying conditions has been based on that assumption, among others. But while it has been discussed in Congress from time to time, nothing definite ever has resulted.

There's not much Congress can do about international oil trade unless it imposes formal import controls, which at the moment appears unlikely. But it may take a look at the naval petroleum reserves, set up many years ago to provide oil for the Navy in time of war but never widely exploited for that purpose.

The Elk Hills reserve in California has been developed to a point where it could produce considerable oil in a fairly short time. But that is as far as the naval reserves go. The Navy has had the idea of finding new reserves for several years. But its attempt to look for one on San Nicolas Island off California was torpedoed by Congress last session.

It would not be surprising if the Navy asked Congress next session to pass a bill authorizing it to go ahead with its program. Department officials have said they will hold up their plans until they have a direct mandate.

PRODUCERS NOW can hope days are numbered for scenes like this, but meantime . . .

Troubles Pile Up In West Central Texas

Robert J. Enright
Southwest Editor

ABILENE, Tex.—Oil producers in several areas of the U. S. will benefit little, if any, from any big jump in domestic demand resulting from the Middle East crisis.

This is due not to any lack of surplus producing capacity but to lack of facilities to move the extra oil.

One such area is the big 35-county West Central Texas region shown on the accompanying map.

Plans were being discussed last week by major pipeline executives for a 26-in. line from the area to the Gulf Coast, but nobody knows just when it can be built. (See page 144.)

Operators in this area, one of the oldest producing provinces in Texas, are represented by the West Central Texas Oil and Gas Association, with headquarters in Abilene.

Early this month, members met here for the association's twenty-third annual conference to take stock of their position and plan for the future. They didn't like what they saw. This year has been a bleak one for most, and 1957 looks little better.

West Central Texas has just about every type of producer headache you can name, including:

. . . Depressed crude prices. Prices were slashed 7 cents a barrel this summer to $2.83 a barrel for 40°-gravity and above.

. . . Lack of pipeline space. Few major pipelines serve the area, and most of those which do are running full. Many wells are unable to obtain pipeline connections. Payment to truckers is knocking per-barrel income down even further.

. . . Pipeline proration. A great many wells with connections have had output prorated by the pipelines. This was true long before last summer's Cities Service refinery strike and Phillips Petroleum Co.'s cut of its take by 25 per cent this fall. Many have been prorated by purchasers to half of normal output for more than a year.

Phillips has announced it is lifting proration in Texas, Oklahoma, Kansas, and New Mexico and that it hopes to resume normal purchases by December 1. But the news is not expected to bring many cheers from West Central operators. It is pegged to the provision that pipeline facilities for moving the additional crude are available. And here they are not.

The result of all this has been that both wildcatting and development in the area have fallen off sharply. Independent operators who traditionally have relied on bank loans for development capital are having trouble meeting commitments due to low income from production. In some cases, royalty owners are threatening suit and cancellation of leases due to nondevelopment.

What is happening . . . One hard-pressed operator has this to say:

"My company has 81 wells in Sharon Ridge field of Mitchell, Scurry, and Borden counties which are prorated to 50 per cent of their normal production. Roughly one-third of these wells produce 2 bbl. daily or less. Proration is making it impossible to produce them economically. We had planned a pilot water flood for this field, but such an operation under present conditions is out of the question.

"In Westbrook field of Mitchell County, we operate 11 wells now prorated to 50 per cent of normal output and three others prorated to 80 per cent. The majority of the leases in this area aren't developed. At present producing rates, payout periods for drilling have been stretched out so far that drilling has practically ceased except for that necessary to hold leases."

Another says: "Oil has become increasingly difficult to move even from old leases which have pipeline connections. Under proration set up by one company recently we lost production, not only because of the proration itself, but because the pipeline failed to run the prorated volume it had announced it would take.

"One of our leases was shut in an entire month because no oil was run. Another lease with an allowable of 808 bbl. daily was allowed to run only 274 bbl. of the 646 bbl. it should have run under the pipeline's proration."

A third claims that his firm "has 20 proved locations we could but won't drill due to purchaser proration and the resulting small allowables."

Serious situation . . . One of the most serious situations, West Central operators say, is in Varel field of Howard County. There are now about 75 wells in this field producing from the San Andres—none with connections.

An operator with production there

says "we, along with other operators, have tried for the past year to get a market for this oil. So far, we have only one buyer who trucks out one-half the allowable.

"We have approached all the pipeline companies in the area, and they have refused to consider a connection to the field. Over 6,000 bbl. per day could be produced by wells already completed in Varel. There are as many undrilled proved locations as there are completed wells. Operators have practically quit drilling because of the situation."

The West Central Texas group now lists roughly 1,000 independent-operator and drilling-contractor members.

For more than 21 of its 23 years, it confined its activities almost entirely within the state. This has changed sharply in the last year and a half.

The solution . . . The association feels acutely that West Texas generally and the West Central region in particular badly need more pipeline capacity, including new lines. But it is aware too that before it can get this added outlet, it must somehow generate a higher demand for area oil.

Operators feel almost unanimously that they not only would have this demand now but would have the pipelines too—if it were not for growing imports.

Following this reasoning, West Central officials have been beating a path to Washington for the past 18 months.

Late last month in hearings before the Office of Defense Mobilization, outgoing president P. W. Pitzer, Jr., testified that West Central operators were losing at least $10,000,000 a year due to excessive imports.

Between $8,000,000 and $9,000,000 of this, he said, was due to last summer's 7-cent per barrel price cut. Operators are losing another $1,200,000 a year through having to truck oil.

Last January, Pitzer said, operators in the area trucked more than 450,000 bbl. of oil. Trucking costs ranged from 11 to 37 cents a barrel and averaged about 22 cents.

The association has already been advised, however, by purchaser representatives that its members can expect little relief in the way of higher production due to the sizzling Middle East situation. The pipelines, they say, already are running full.

Operators here nevertheless are hopeful that they may ultimately benefit from the Middle East mess in at least one way. That is that the Government will "finally see the folly of depending on vulnerable foreign oil sources while in the process slowly breaking the back of the domestic industry."

In the meantime, the association plans to keep on pounding away at imports.

Processing Briefs

Construction will start in April on Standard Oil Co. of Ohio's integrated 60,000-bbl. refinery planned at Toledo. The $40-million plant is scheduled to go on stream in April 1958.

It will occupy 20 acres within the grounds of the Sohio Toledo refinery and will replace part of the present facilities *(The Oil and Gas Journal, October 8, page 116)*. Production will include L.P.G., solvent naphthas, kerosine, furnace oil, heavy fuel oil, petroleum-coke diesel fuel, and automotive and aviation gasolines. The plant will feature combination processing, with a central communications center providing over-all control.

A multimillion dollar synthetic-rubber plant is planned for Red Deer, midway between Calgary and Edmonton. It is believed the government-owned Polymer Corp. will build it.

The company has taken an option on 1,100 acres of land 8 miles northeast of Red Deer and Federal Trade Minister Howe said last summer that Alberta was being considered as a location for a plant of the crown corporation.

Imperial Oil, Ltd., is going to add 2,500 bbl. daily to its 15,000-bbl. Winnipeg refinery and install a Powerformer to upgrade quality. The expansion program will cost between $4,000,000 and $5,000,000. The plant gets its crude through the Interprovincial pipeline from Alberta.

American Oil Co. will add a second 21,000-bbl. Ultraformer at its 160,000-bbl. Texas City, Tex., refinery. Ralph M. Parsons Co. has the contract to build it, starting next April. Completion is scheduled for early 1958. The unit, equipped with desulfurization facilities, will be a duplicate of one put on stream at the refinery in February 1955.

Catalytic Construction Co. of Philadelphia has been awarded the contract to build a new $2-million Houdriformer unit for Texas City Refining, Inc., at Texas City. The unit is scheduled to go on stream late in 1957. The unit will have a capacity of 7,000 bbl. daily.

Vickers Petroleum Co., Inc., will construct a 3,500-bbl. Ultraformer at its 17,000-bbl. refinery at Potwin, Kans., northeast of Wichita. Utilizing a special catalytic reformer process, the Ultraformer will be constructed by Ralph M. Parsons Co., Los Angeles. Completion is scheduled in May.

Shell Development Co.'s agricultural research department in Denver is being consolidated with the firm's agricultural center and experimental farm at Modesto, Calif. About 50 persons at Denver will be transferred to Modesto by next fall.

The Modesto staff, which will be expanded to about 100 persons with the consolidation, will be under the supervision of S. H. McAllister, now research division director at Denver.

Tidewater Oil Co. has put a new gas-processing plant into operation at its Martinez, Calif., refinery. It's the second of three units completed in a major expansion program.

Capacity of the plant is 88,000 M.c.f. of gas daily. A 24,000-bbl. hydrodesulfurizer went on stream last month. A 42,000-bbl. daily fluid coker is the third major unit under construction.

Also for Refiners . . .

The Independent Refiners Association of America is unhappy with the Government for failing to consult the association in developing plans following the Middle East crisis (P. 129) . . . An Indiana Standard executive cited the lesson to be learned from the fire at Indiana's Whiting refinery. It is: The conventional approach to design and operation of process units needs a thorough review and some modifications (P. 132) . . . A.P.I. starts issuing semimonthly reports on L.P.G. and L.R.G. stocks (P. 146) . . . Jefferson Chemical plans a big expansion in ethylene facilities at Port Neches (P. 147) . . . Commercial Solvents and Columbia Gas will form a company to build an ethylene plant in the Ohio Valley (P. 151).

PLUS THESE TECHNICAL FEATURES: Dry-gas cycling yields 10,600 bbl. for Mene Grande (P. 160) . . . How the heating-fuels industry can get better odds on long-range weather bets (P. 174-199) . . . New Rexforming unit makes 104 octane for Cosden Petroleum (P. 238) . . . What the hydraulic rich-oil motor is doing for field processors (P. 145) . . . Converted tankers may transport L.P.G. (P. 255) . . . Refiner's Notebook (P. 263) . . . and W. L. Nelson charts the cost of insulating (P. 265).

L.P.G. "Lays In" at Chalk Mine

TUSCALOOSA, Ala. — The nation's first chalk mine for storing L.P.G. is apparently a success.

Owned jointly by Tuloma Gas Products Co. and Sinclair Oil & Gas Co., the 5½-million-gallon reservoir was all but full last week. At that time, officials said capacity would be reached "within a matter of days."

The underground storage, located at Demopolis, some 60 miles southwest of here, is the first of two to be carved out of Selma chalk. The second is due for completion early next spring. It will add 8½ million gallons and bring total capacity at the project to 14 million gallons.

Installations above ground include a dehydrator, supplementary steel storage, tank-car and tank-truck loading facilities, and an air-conditioned office. The 20-spot double rack for tank-car loading can be enlarged to handle 40 cars at the same time.

Tuloma, operator of the installation, says it is too early to report fully on the success of the venture, but that no noticeable seepage has occurred since product injection was started in July *(The Oil and Gas Journal, June 11, page 86)*.

The company is not anticipating any problems and expects 95 to 100 per cent recovery when the cavity is emptied next spring.

Idea might spread . . . The project has been getting a lot of attention from the industry. In the past, storage has been confined mostly to salt cavities or caverns mined in shale, hard limestone, or other hard-rock formations.

The Alabama project could signal the start of a big underground storage program since chalk is found in many areas once considered impractical for underground installations. Chalk is impervious and requires no sealant.

Tuloma and Sinclair selected the Alabama site because it was near rail, highway, and water transportation. Extensive tests convinced them the chalk formation would be suitable for storage of L.P.G. Construction time and costs have proved about the same as for other mined-storage projects.

Tanker Champ on Maiden Trip

SAN FRANCISCO. — The Universe Leader, by far the biggest of the new giant tankers which are writing a new chapter in crude transportation, arrived here last week on its maiden voyage with 557,480 bbl. of crude.

The 84,730-ton vessel, which is heavier than the Queen Elizabeth, delivered a load of crude from Caltex fields in Sumatra to the Standard Oil Co. of California terminal at Richmond.

Part of the vessel's cargo was lightered off into barges at an anchorage in San Pablo Bay before the ship berthed for final unloading. Fully loaded, the ship could have passed under the Golden Gate bridge at high tide with only 2 ft. to spare.

The ship has been assigned to the Sumatra-San Francisco run. It will be used under an afreightment contract, rather than under charter, between California Transport Corp., the California Standard shipping subsidiary, and the vessel owners, Universe Tank Ships, a National Bulk Carriers, Inc., company.

Under the contract, the owners agree to deliver a certain amount of crude to Richmond. They have agreed informally to use the Universe Leader in making deliveries.

Capacity of the vessel is 620,000 bbl. It was launched in Kure, Japan, in August. The 855-ft. tanker is shorter than the Queen Elizabeth, but its 125-ft. beam is 6 ft. wider. Its draft is 46 ft. and it travels at an operational speed of 15 knots.

Amerada Runs Heavy String

WILLISTON, N. D.—One of the heaviest strings of casing ever set in the Rocky Mountain region has been run at Amerada Petroleum Corp.'s Iverson-Nelson Unit 1. The well is a deep test in the southern part of North Dakota's Beaver Lodge field.

A crew of 10 men spent 10 hours running 11,194 ft. of the 9⅝-in. o.d. steel pipe into the well. The casing had wall thickness of ½ in. and is capable of withstanding extreme heat and outside pressure of 1,250,000 lb. per square foot. The well had been drilled to top of the Silurian formation where heat is 268° F. The pipe was cemented with 1,800 sacks around the outside string.

A total of about 8 miles of pipe in four strings costing $170,000 will be required to complete the well where testing and drilling is still continuing. Total depth is expected to reach 14,000 ft. Previously 13⅜-in. casing was set at 3,900 ft. Smaller casing and tubing will be run when total depth is reached.

Industry BRIEFS

Long Beach last week handed the State of California a check for $122,339,133.89 representing the state's claim on tidelands oil and gas revenue up to February 1, 1956.

The next payment for the period, February 1 to December 1, 1956, falls due December 5. However, state and city officials have hit a snag on agreeing on the city's liability for that period. A 3-hour conference between Long Beach and the state resulted only in the agreement on the December 5 due date. Meanwhile, the two parties will work out the legal and accounting problems on the second payment, which is expected to run into several million dollars.

Alberta's 18 trillion cubic feet of proved and recoverable natural-gas reserves will climb to 88 trillion cubic feet by 1980, the Canadian Gas Association of Toronto forecasts.

The group also revealed that a recent survey places reserves for all of western Canada at 22½ trillion cubic feet. British Columbia accounts for 3½ trillion of this and Saskatchewan 500 billion.

Imperial Oil Co., Ltd., bid $194,243 for exploratory rights on 96,160 wildcat acres in the East Poplar area of Saskatchewan. The sale covered a total of 1,405,943 acres in five areas of southern Saskatchewan and brought $612,716,000. Ten companies offered 28 bids on 15 parcels, all of it in wildcat acreage.

Devon-Palmer Oils, Ltd., has been formed in Calgary through the merger of Devon-Leduc Oils, Ltd., and Rio-Palmer Oils, Ltd. R. L. Wheelock of Corsicana, Tex., is chairman and Morris N. Palmer of Calgary is president.

U. S. subsidiaries owned by the new corporation include Devon-Delaware Oils, Ltd. (Delaware), Palmer Oil & Gas Co., Inc., and Devon Uranium Co., which holds mining properties in New Mexico. Devon-Leduc oil reserves in 1955 were estimated in excess of 5,185,084 bbl., most of them in Alberta. Rio-Palmer's crude reserves were estimated at about 3,074,864 bbl.

The U. S. Supreme Court in effect has confirmed the authority of the Federal Power Commission to reject gas producers' initial filings of rates higher than those in effect June 7, 1954. The court last week refused to review a lower-court decision which supported FPC in its rejection of initial rates filed by Cities Service Gas Co.

Ethylene Plant Set

Petrochem operation would be second for Ohio Valley

NEW YORK.—A second petrochemical plant manufacturing ethylene is in the making for the Ohio Valley.

Commercial Solvents Corp. and Columbia Gas Systems, Inc., both of New York City, are ready to conduct engineering and economic studies of the proposed venture, expected to cost between $40 and $50 million.

The companies agreed to go ahead with the project after looking it over carefully for several months. Tentative plans call for construction to start early in 1957 "after necessary regulatory authorizations have been obtained."

Officials said long-range plans call for the formation of a jointly owned company and "recognizes the possibility that the new company may ultimately be engaged in the entire field of ethylene and other hydrocarbon derivatives."

Columbia Gas will furnish the raw materials for the plant from its substantial natural-gas reserves in the Appalachian area.

The only other petrochemicals plant in the Ohio Valley is owned by Olin-Mathieson Chemical Corp. Located at Brandenburg, Ky., it manufactures a full range of products in the ethylene field.

Raw materials for the facility are natural-gas liquids from Tennessee Gas Transmission Co.'s low-temperature, liquids-extraction plant at Greensburg, Ky.

Storage Projects Opened

LOS ANGELES. — Two Southern California underground gas storage facilities, with a total capacity of 13.8 billion cubic feet and representing an investment of more than $25 million, have gone into full operation.

They include Pacific Lighting Gas Co.'s new $10.3 million operations at the Montebello field in east Los Angeles, with a capacity of 12.5 billion cubic feet, and Southern California Gas Co.'s $15 million storage field at Playa del Rey, with a total capacity of 1.3 billion cubic feet. The latter is designed to take care of peak-load, emergency requirements.

The gas is being injected into the 8-1, 8-2, and 8-3 zones of the West Montebello field, found at 7,000-8,300 ft. Injection is accomplished with six 1,350-hp. compressors set in a crater carved out of a hilltop to hide them from view and as a noise suppression measure. Ultimate withdrawal capacity will be 200 million cubic feet per day.

Pipeline BRIEFS

Alberta Gas Trunk Line Co., Ltd., has granted its first construction contract to Mannix, Ltd., of Calgary. Alberta Gas will pick up gas for Trans-Canada Pipe Line Co., Ltd.

The contract calls for a 2,600-ft. submerged pipeline crossing of Red Deer River near Cavendish, Alta. It is on the proposed lateral from the main east-west line to the Blindloss, Sibbald, and Provost gas fields.

Trans Mountain Oil Pipe Line Co. has begun engineering studies for a major expansion of its crude system from Alberta to Washington. Capacity will be increased to 300,000 bbl. per day.

The new expansion was announced even before completion of the one now under way. New pumping stations are scheduled to boost capacity to 200,000 bbl. per day by mid-1957. Throughput last month averaged 159,000 bbl. per day, more than double the average for the first quarter of 1955.

Western Pipe Line, Inc., Austin, Tex., has received the contract for three 30-in. bay crossings on Texas Eastern Transmission Corp.'s 422-mile line from McAllen to Beaumont. Western will build the crossings at Nueces, Lavaca, and Carancahua bays. Missouri Valley Dredging Co., Omaha, has the contract for Hinds Bay and Guadalupe Bay crossings.

Westcoast Transmission Co., Ltd.'s 30-in. Peace River outlet is nearly two-thirds complete, according to company officials. They say 407 miles of pipe for the big gas line has been welded. Final delivery of pipe is expected next July.

Trans-Canada Pipe Line Co. reportedly has signed a 20-year contract to supply gas to a newly formed company, Provincial Gas & Northern Quebec, Ltd. Norman Grimand, secretary-treasurer of the Quebec company, said $4,000,000 may be spent to pipe gas to Rouyn, Normanda, and other areas near the Ontario-Quebec border.

Peoples Gas Light & Coke Co. plans to purchase up to $10 million of additional common stock in its subsidiary, Peoples Production Co. Peoples Production is engaging with Sinclair Oil & Gas Co., Sohio Petroleum Co., and El Paso Natural Gas Co. in exploration in the Gulf of Mexico. Peoples entered into exploration to provide supply insurance for utilities in the six-state Midwestern area it serves.

Natural-gas sales by pipeline companies increased 11.6 per cent during the year ending in August 1956. The Federal Power Commission reports sales of gas for resale for the year totaled 5,793,150 million cubic feet, as compared with 5,188,414 for 1955.

Sales to ultimate consumers by the companies totaled 1,439,786 million cubic feet for the year ending August 1956, as compared with approximately 1,291,424 the previous period. Figures are based primarily on reports from 36 natural-gas pipeline companies.

Ohio Fuel Gas Co. has pumped a record 163 billion cubic feet of natural gas into its eight Ohio underground storage areas in preparation for the winter heating season. Most of the gas comes from the southwest. The storage areas are natural reservoirs emptied of native gas. The firm serves 389 towns in the state.

Also for Pipeliners . . .

Pipeliners at the A.P.I. touched on a variety of subjects ranging from the effects of the Middle East crisis on domestic transportation to the possibilities of moving chemicals by pipeline (P. 127) . . . A new pipeline-coating process developed by Gen. P. H. Timothy is put to work as Brown & Root lays a 28-mile line for Southern Natural Gas in Louisiana's marshes (P. 140) . . . Pipeline executives at the A.P.I. formulated plans to build a 26-in. crude line from West Texas to the Gulf Coast (P. 144) . . . West Central Texas operators are plagued by a lack of pipeline outlets (P. 148) . . . Wilhelmshaven has been picked as the North Sea terminus for a 400,000-bbl. daily crude pipeline planned by a group of refiners into West Germany (P. 152) . . .

PLUS THIS TECHNICAL FEATURE: Pipeline Patrol covers centrifugal compressors (P. 273).

Big Sahara Strike Hinted

French claim discovery in remote part of desert points to new field with oil reserves of seven-billion barrels

THE French claim their latest discovery in the Sahara region of Algeria may result in a field with 7,000,000,000 bbl. of reserves.

The discovery, Hassi Messaoud, 63 miles southwest of Ouargla, was first revealed 2 months ago. At that time Soc. Nationale de Recherche et d'Exploitation des Petroles en Algeria (SN REPAL), owned jointly by the French and Algerian governments, said it had encountered "substantial quantities of oil of excellent quality" in a thick productive zone *(The Oil and Gas Journal, September 24, page 105)*.

Last week the newspaper, Journal D'Alger, reported that recent tests have indicated a field covering 3,600 sq. miles of the desert area. The newspaper gave no details except for the reserve estimate. It said the productive zone encountered was 60 ft. thick.

The region is in the middle of a vast uninhabited desert more than 500 miles south of Algiers and Mediterranean ports in that area. Any such discovery would have to be big to make pipeline transportation to the sea pay. Reports would indicate that the French are testing the size of the productive area to determine if it is big enough.

Drilling for size . . . At Edjele, about 390 miles to the southeast where a French-Shell company made an earlier discovery, the "drilling-for-size" operation has been carried out in a similar fashion.

Edjele 101 was completed in January near the still undefined border between Algeria and Libya's state of Fezzan. It tested 19 bbl. an hour of "light oil of good quality" from carboniferous sandstone at about 1,475 ft. *(The Oil and Gas Journal, February 13, page 95, and May 21, page 145)*.

Since that time Cie. de Recherches et d'Exploitation de Petrole au Sahara (C.R.E.P.S.) has drilled four widely spaced wells. Three of the four were producers capable of making 56 bbl. an hour. All are shut in.

C.R.E.P.S. drilled the four test wells on a north-south axis 18 miles long and on an east-west axis 72 miles long. The fact that three of the four were productive would indicate a very sizable structure.

This would confirm optimistic comments made in recent months by Guy Mollet, the French premier, that the oil future of France may well lie in the Sahara desert. The French Government recently published advertisements aimed at 1,000 young men released from military service in North Africa offering them jobs in the oil fields of the Sahara.

Crude Line Planned

North Sea terminus picked for line into West Germany

THE German port of Wilhelmshaven last week won out over Rotterdam as the North Sea terminus of a 400,000-bbl. daily crude pipeline to serve the refining centers in the industrial Ruhr area of West Germany.

Six West German refiners, headed by affiliates of Standard Oil Co. (N.J.) and British Petroleum Co., Ltd., have formed North-West Oil Pipelines Co., to build the line. It will cost $46,200,000.

Wilhelmshaven was picked over Rotterdam as the North Sea port of the line after the central government of West Germany and the state government of Saxony offered to foot the bill to dredge the harbor to 40 ft. to accommodate big tankers. The central government will spend $8,500,000 and Saxony another $3,000,000 on this job.

The ownership . . . Esso AG, building a 100,000-bbl. daily refinery at Cologne —farther south and east than any now located in Germany, will own just less than a half-interest in the pipeline company. Esso may expand the capacity of its refinery by another 20,000 to 40,000 bbl. daily before it is completed.

Benzin & Petroleum Co., the West Germany subsidiary of British Petroleum Co., will own less than one-quarter interest in the company. The remaining interest will be owned by four German refining firms, Ruhr bau-Mineralolraffinerie, Ruhr-Chemie, Scholven-Chemie, and Union Rheinsche.

The German affiliate of the Royal Dutch-Shell Group was originally included in the group of companies considering the refinery, but the Shell company withdrew. The Shell company said it would use the line if it were built *(The Oil and Gas Journal, July 30, page 138)*.

Plans now call for completing the 210-mile pipeline for use by early in 1959 with a daily throughput of 68,000 bbl. daily. It is expected to be operating at 400,000 bbl. daily by 1965.

Panama Deal Bared

Kansas firm will explore concession for interest

TIME PETROLEUM CO., Wichita, Kans., will explore concessions of more than 1,000,000 acres recently granted Cataract Mining Corp., New York, in the Chiriqui Province of Panama.

Time Petroleum has agreed to spend more than $1 million on its aerial and geological mapping, gravitymeter and seismic surveys, and paleontological interpretation of the area. In return, the Kansas independent will receive checkerboard acreage in the concession.

Actual work in Panama will be done by Time Petroleum, S. A., Panamanian affiliate of the Kansas company. R. J. Schreiner, chief geologist for Time Petroleum, is in charge of the operation and plans to send a staff of geologists, engineers, and paleontologists to David, where a base of operations has been set up.

Cataract Mining obtained exploration concessions totaling more than 2 million acres on both sides of the Panama Canal. But most of the acreage lies in Chiriqui Province adjoining the Costa Rican border *(The Oil and Gas Journal, September 17, page 138)*. The company reported 2 months ago that it was negotiating farmout deals with two major oil companies.

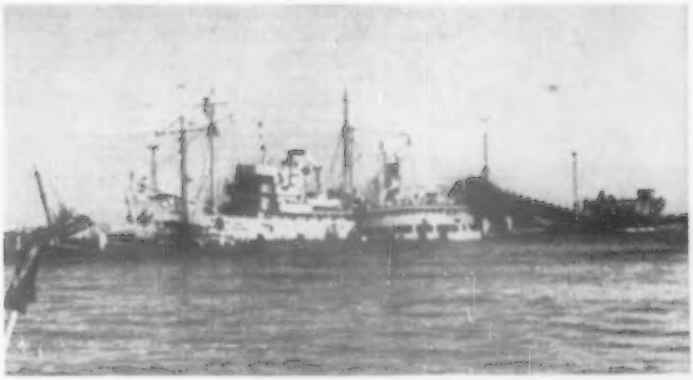
Honduran Drilling Stopped

British Honduras Gulf Oil Co. has called a halt to its drilling operation in British Honduras and will review all the data obtained from two dry holes before more drilling.

The Gulf Oil Corp. subsidiary said last week it will continue geological and photogeological work in the British crown colony, but said studies of all its data are essential before it carries on any further drilling.

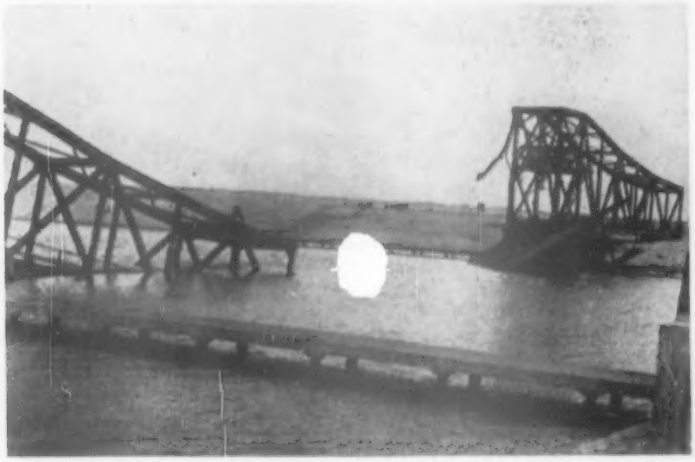
Santa Fe Drilling Co. moved its rig out of the Central American country after Hillbank 1 was abandoned as dry at 6,650 ft.

THIS SUNKEN SHIP juts out of water.



PORT SAID HARBOR is blocked by at least 20 ships lying awash or submerged.

AERIAL PHOTO shows another ship awash.



FIRDAN BRIDGE was knocked out, blocking canal just north of Ismailia.

Clearing Suez May Take Months

Paul Swain
International Editor

THERE may be as many as 50 vessels of assorted sizes sunk in the Suez Canal and in the harbor facilities at both the north and south entrances.

This revised estimate of the damage to the water link between the Western World and Middle East's oil confirms fears that it may take months to put the canal back in operation *(The Oil and Gas Journal, November 12, page 122)*.

With only a fraction of the length of the canal in British and French hands last week and an uneasy truce existing throughout the area, estimates of the time involved and the cost began to soar. The Egyptians insist they will not allow the British and French to begin salvaging operations in the entire canal. In the northern portion in Anglo-French hands, the work may start this week in spite of Egyptian objections.

Where they are . . . Comdr. J. R. L. Moore, British naval officer in charge of the Port Said clearance, said at least 20 vessels are lying awash or submerged at the north entrance of the canal. The main barrier at the north end of the waterway is eight ships in a horseshoe bend across the channel. One is the world's largest seagoing dredge, the Paul Solente, which has eight holes blown in her hull.

This dredge and most of the maintenance fleet of the old Suez Canal Co. has been scuttled in the canal. Included are two heavy refloating vessels, Castor and Polluz, three big floating cranes, and several tugboats.

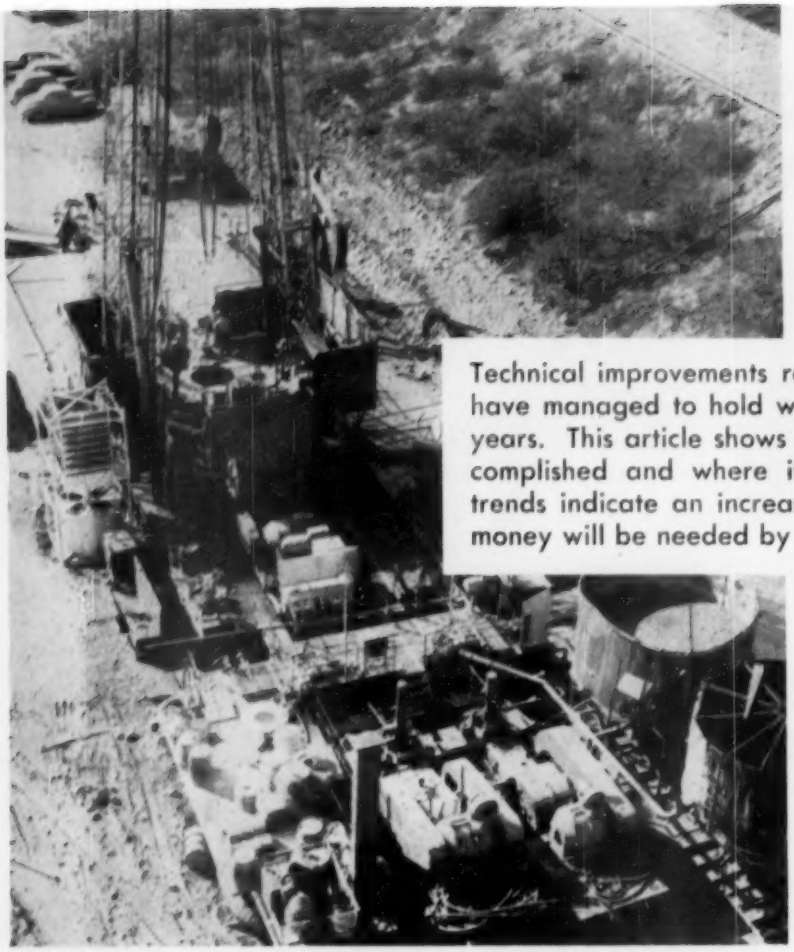
This means of course that all salvage equipment used in the canal clearing job must be brought to Egypt from the outside. Last week French and British said they have a salvage force of 30 ships and 1,200 men on the way to the canal from bases at Malta.

In addition to the 20 or more craft scuttled at Port Said, at least eight or nine are believed in the canal between Port Said and Suez, and there may be another 20 or more at the Suez entrance. All this is addition to the Firdan Bridge which also blocks the canal.

Tanker caught in canal . . . In addition to the scuttled vessels, there are still about a dozen ships bottled up in the canal that were trapped there when the fighting started. None of these is believed to be damaged, but if the fighting should flare again, they could add to the hazard.

One of these is the 39,000-ton Statue of Liberty, a Cities Service Co. tanker.

The U. S. State Department, at the request of Cities Service, last week told the Egyptian Government that it expects Egypt to take all necessary measures to insure the safety of the vessel and its crew. Cities Service says the vessel carries a crew of 50, all Dutch. The crew has left the ship at the instructions of Egypt.



Technical improvements resulting from drilling research have managed to hold well costs in check in the last 5 years. This article shows what drilling research has accomplished and where it should be headed. Drilling trends indicate an increase of 60 per cent in research money will be needed by 1965.

by
Douglas Ragland

Well Costs Flatten Out at 1950 Levels

. . . thanks to better technology sired by research

ALTHOUGH there has been a substantial increase in basic cost items in the drilling industry, well costs in the last 5-year period have been maintained at approximately 1950 levels. This improvement in drilling efficiency has resulted primarily from the effect of technological improvements brought about by basic research in drilling.

Drilling research represents an extremely small item in the drilling and producing industry's budget. In consideration of the outstanding results obtained from the research performed to date, and in view of a long and impressive list of problems which deserve research attention, expanded effort is needed.

Author is chief petroleum engineer, Humble Oil & Refining Co., Houston. Paper presented at annual A.P.I. meeting, Chicago, November 14, 1956, under the original title, "The Effect of Modern Drilling Technology on Well Cost."

Well cost, or the annual expenditure which is made to drill and complete new wells, is the principal capital outlay of the domestic petroleum industry. In fact, the more than 3 billion dollars[1] invested in new United States wells in 1955 represents over 40 per cent of the market value of the crude-oil and gas production for that year. In view of the trend toward deeper and costlier wells, indications are that this ratio of expenditure to income will increase unless the industry can find ways to decrease unit costs and drill fewer unnecessary development wells.

The question of technical improvement, the chief cost-control weapon of any industry, is a vital one to petroleum.

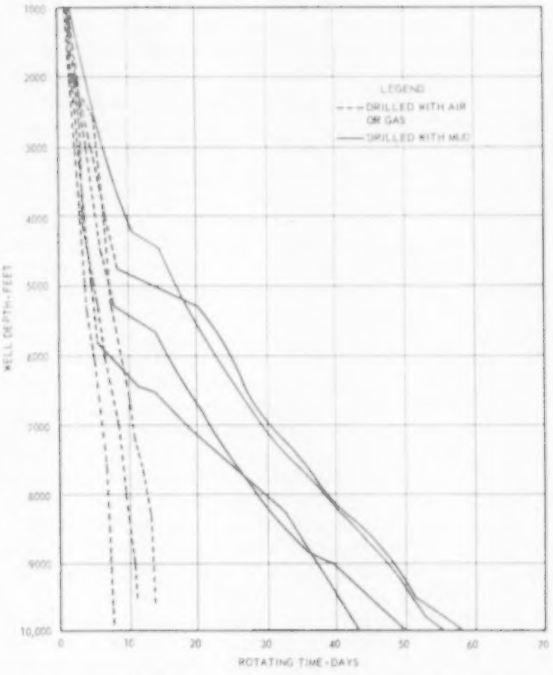
The Drilling Industry

For the purposes of this discussion, drilling activity in the United States will be considered, a refinement which rules out but an estimated 17 per cent of the total rotary and cable-tool rigs available for operation in the free world. The domestic drilling industry is made up of more than 800 drilling contractors and oil operators who own over 5,000 rotary and cable-tool rigs. An estimated 80 per cent of the total are rotaries.[2] The output, or gross business, of these rigs is measured in terms of the total cost of the oil and gas wells drilled and completed and not merely in terms of drilling cost alone, which, on the average, is less than half of total well cost.

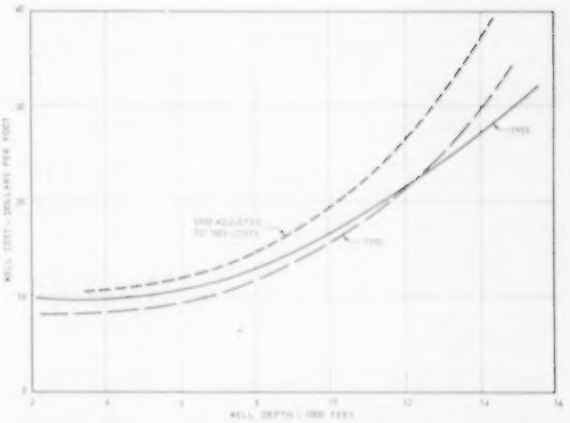
Thus drilling technology, as discussed herein, includes all of the technological specialties called for between rigging up and moving the rig. It ranges from the fields of metallurgy, equipment design, and hole-making technique to the tech-

Special Section . . . Featuring

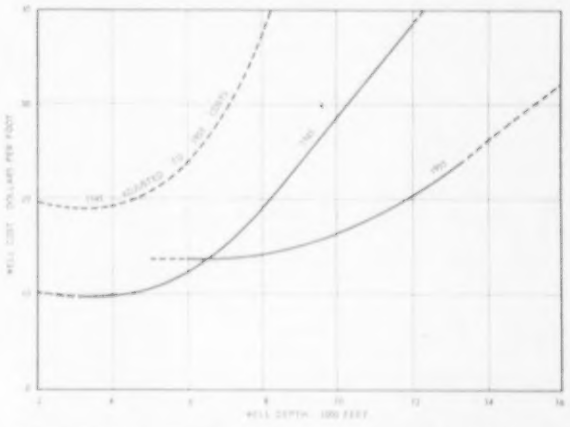
A.P.I. Chicago papers and other selected articles



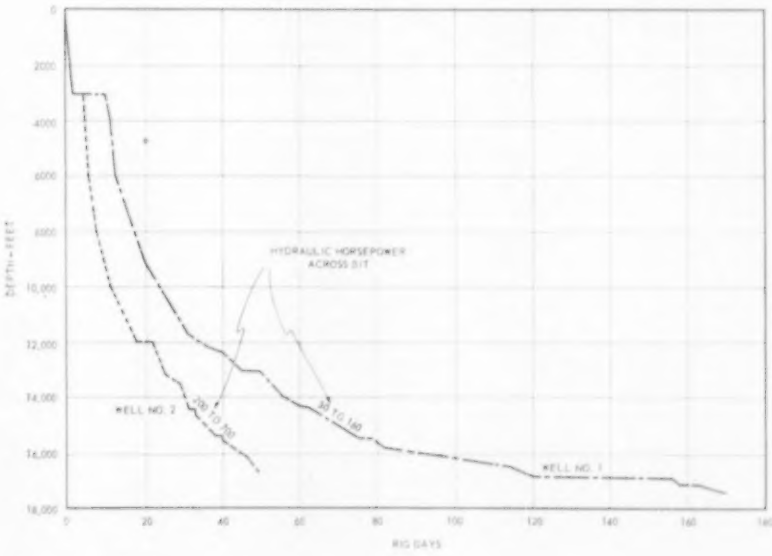
AIR DRILLING has speeded penetration rate, lengthened bit life. Research indicated that less pressure on the drilled formation is a factor and aerated muds have proved it. Wells above were in Southwest Texas. Fig. 2.



WELL COSTS in 1955 were slightly greater for shallow wells and slightly less for deep wells than in 1950. When 1950 costs are adjusted for the increase in equipment, labor, and service prices, 1955 wells are all cheaper. Data from over 800 wells in western New Mexico, Texas, and southern Louisiana. Fig. 3.



WEST TEXAS COSTS of wells show even more strikingly how much drilling has improved. On the basis of unadjusted prices, 1955 average costs on 125 wells are lower than average costs on 87 wells drilled in 1945. Fig. 4.



Here's the story in a "chart-shell" of how drilling costs have held the line.

MORE HYDRAULIC HORSEPOWER at the bit has meant faster drilling in soft-rock areas. These wells were in South Louisiana, had comparable mud, bits, drill pipe, hole sizes, hoisting equipment and casing program. Fig. 1.

nical requirements of formation evaluation, casing practice, and well completion. It is all inclusive as respects any factor which goes into total well cost.

Research and development carried out by the drilling industry apply more or less to all of these technical fields. This does not signify that the drilling contractors and oil operators do all of the research. It goes only to explain that the drilling industry, taken in its broad aspect, pays for and thus should be credited with a very wide range of technical effort.

Drilling Research and Development

In spite of the many technical complexities associated with drilling, and in spite of the overwhelming importance of well cost to the petroleum industry—an industry noted for its aggressiveness in refining, production, and geophysical research—laboratories devoted to drilling research and development are hardly to be found. This does not in itself mean that a significant amount of such work is not done, but the absence of abundant dedicated facilities is indicative of an effort likely to be spasmodic in nature. These circumstances explain the difficulty of reaching a satisfactory estimate of the total industry drilling research and development effort.

Why does this situation exist while the industry continues to enjoy its reputation for over-all research aggressiveness? Basically, the answer lies in the nature of the drilling phase of the industry. There are but few operators of drilling rigs, drilling contractors and oil operators as well, who control more than one or two rigs. Even the largest owns only 125 (rotary) rigs, less than 3½ per cent of the nation's total (rotary).

The drilling-equipment, supply, and service industry is somewhat more concentrated; but even here there are no "giants" who could be expected to make research showings comparable to those of the electrical, chemical, and automotive industries. Even the oil operators who pay the total well costs and who, in the final analysis, have the most direct interest in drilling research and development are made up of such a large number of individual companies that on the average no one company drills more than about 3 or 4 per cent of the total dollar value of all wells for any one year.

Thus, it is not surprising that drilling research and development effort is widely scattered and varies from substantial contributions on the part of some of the larger equipment suppliers and oil operators to occasional field tests carried out by many small contractors.

"The question of adequacy of past expenditures for drilling research and development presents a problem with no exact solution . . . If gross business is the proper gage, then all indications are that petroleum-industry activity in the fields of drilling research and development should increase steadily."

What is spent . . . The total industry expenditures for drilling research and development can only be guessed at. A limited sampling of tool and equipment manufacturers, drilling contractors, and oil operators places the domestic industry figure in the range of 12½ million dollars invested in drilling-research and development of all types during the year 1955. Of this amount, 2½ million went to pay for offshore projects, which, because of their highly specialized nature, should probably be considered apart from the general field of drilling research. If this is done, then the industry figure for 1955 becomes 10 million for general drilling research and development. This represents about one-third of 1 per cent of the 3-billion-dollar gross business handled by the industry for that year, and it is believed this ratio of research expenditure to total expenditure has remained about constant for the past several years.

Regardless of the accuracy of these guesses, the question of whether the industry's research and development effort is adequate cannot be answered directly. A. W. Thompson* has long been concerned that the drilling contractor, at least, is spending too little on research, although he has not commented on the over-all industry record.[3] A recent report on industrial research indicates that a wide range of industries is spending from "less than 1 per cent to more than 6 per cent" of sales on research.[4] On this basis, 1 per cent of gross business would seem to be on the low side.

For the drilling industry, an "acceptable minimum" of 1 per cent of gross business would amount to about 30 million dollars annually at current levels of activity, or about three times 10 million dollars per year, which we guess to be the amount now being spent. However, regardless of interindustry comparisons, a more convincing test of adequacy is an appraisal of tangible results in terms of technical advancements and cost reductions.

Recent Technological Improvements

Although the drilling research and development program has failed, during the last decade at least, to produce any single revolutionary or radical improvement, it has contributed an increasing stream of lesser but significant developments. Some of the more important of these are:

1. Better hydraulics. Large increases in drilling rate have been made possible as the result of extensive research in the field of drilling hydraulics.[5] Knowledge derived from this work has led to the development of "jet-drilling technology," or the effective application of increased bit weights made possible by the correct utilization of high-velocity jet streams at the bit head for efficient cutting removal. It has provided the driller, for the first time, with a sound technical basis for sizing the rig hydraulic components.

As an example of this development (Fig. 1), a well drilled in 1952 in South Louisiana with only 50 to 160 hydraulic horsepower available at the bit required 120 days to reach a depth of 17,000 ft. In 1955, a nearby completion utilizing 200 to 700 hydraulic horsepower at the bit required only 50 days to reach a depth of 16,906 ft., for a reduction of 57½ per cent in drilling time. In drilling the two wells, comparable mud, bits, drill pipe, hole sizes, hoisting equipment, and casing programs were used, except the bits for the more recent well were equipped with proper jets to utilize the full advantages of the increased power of the hydraulic system.

2. New tooth design. Exhaustive laboratory and field investigations have provided a better understanding of the mechanics of chip generation by rolling cutter type of bits—knowledge which has led to highly significant improvements in the tooth designs of both hard and soft-formation bits. Out of this research came the radically new tooth which is not a tooth at all but is a rounded button of tungsten carbide imbedded in a smooth roller. In spite of its harmless appearance, this new design proved far superior to any other for certain extremely hard formations, and it quickly became known as the "chert bit."[6]

Prior to this development, a typical 106-ft. section of chert in Yarbrough and Allen field, Ector County, Texas, required 20 conventional hard-formation bits and 74¼ hours rotating time.

*A.P.I. vice president for production; past president, A.A.O.D.C.; president, A. W. Thompson, Inc., Houston.

TABLE 1—COMPARISON OF DRILLING RESULTS USING DIAMOND BITS AND ROLLER-TYPE BITS—FRIO AND VICKSBURG FORMATIONS, SOUTHWEST TEXAS

Area—	Interval, ft. From	Interval, ft. To	Footage drilled	Bit size (in.)	No. of bits Diamond	No. of bits Roller*	Footage per bit Diamond	Footage per bit Roller*	Est. saving* Rig days	Est. saving* Well cost
Armstrong Ranch, Kenedy County	10,000	16,000	9,045	6 and 6⅜s	10	139	904	65	54.0	$108,000
Kohler Ranch, Duval County	8,928	10,827	1,764	6	1	30	1,764	59	12.8	21,200
Kelsey field, Starr County	8,307	9,500	1,067	6	1	16	1,067	67	3.5	4,200
Kelsey field, Starr County	8,005	9,982	1,756	6	1	26	1,756	67	1.4	2,000
Angel City field, Goliad County	8,457	10,500	1,465	6	1	14	1,465	104	4.0	4,700
Sebastian area, Cameron County	9,731	11,180	1,349	8½	1	10	1,349	135	1.5	1,500
Total			16,446		15	235				$141,600

*Estimated from records on offset wells.

TABLE 2—COMPARISON OF GAS VS. MUD DRILLING—VINEGARONE FIELD, SOUTHWEST TEXAS. COMPARABLE HOLE SIZE AND DRILLING EQUIPMENT

	Total days	Interval (ft.)	Footage drilled	Hours rotated	Ft. drilled/ hr. rotated	Footage per bit	No. of bits used
Well No. 1—Mud operations	80	1,500-9,504	8,000	1,198.0	6.7	62	128
Well No. 2—Gas operations	22	1,581-9,500	7,919	224.25	35.3	377	21
Well No. 3—Gas operations	13.7	1,594-9,950	8,356	183.5	45.5	557	15

A single chert bit now drills the same section in 26 hours and saves 19 round trips with the drill pipe! In all, drilling cost for this difficult formation has been reduced from $143 per foot to about $25 per foot.[7]

3. Diamond bits. Other important bit research work has centered around diamond drilling and core bits. The usefulness of these formerly limited-application tools has been extended by virtue of the developments of more erosion-resistant matrix material for holding the diamond cutting elements, improved fluid-discharge patterns at the bit head, and the adoption of advanced drilling techniques involving appreciably increased drilling weights and rates of circulation.

A recent application of these improved drilling tools in a deep well drilled in the Southwest Texas area (Armstrong field, Kenedy County) permitted an estimated 50 per cent reduction in drilling time for medium-hard but highly abrasive formations encountered at 11,000 to 16,000 ft.. The saving amounted to forty-four 24-hour days of drilling time.[7]

Table 1 summarizes experiences in other areas of Southwest Texas where diamond drill bits have been unusually effective in drilling Frio and Vicksburg formations. The 15 diamond drill bits listed averaged 1,096 ft. per bit and saved an estimated $9,400 each in over-all drilling cost. This saving is not attributed to any exceptionally high drilling rate, but to the long bit life obtained and the consequent reduction in trip time to change bits.

Use of the diamond drill bit in its present form is limited primarily to abrasive and nonfriable formations, inasmuch as the small size of the cuttings produced by the diamonds does not permit the diamond drill to compete with the rolling cutter-type rock bit in most formations. However, where it is desired to core the formation rather than drill it, the diamond core bit has gained practically universal acceptance because of the higher percentage recovery and the larger-diameter core which it obtains.

4. Designed mud properties. Many laboratories engage in limited amounts of research on drilling-fluid (mud) properties, and this work has been essential to the development of modern rotary-drilling technique. During the past few years, oil-emulsion muds have been perfected to combat sloughing formations and increase drilling rates. Also, the use of low-density mud, or the substitution of water for mud to increase drilling rates, has come into widespread use, particularly in hard-formation areas.

Use of water as a drilling fluid, where formation pressures permit, has long been known to increase rates of penetration over those attained with higher-density muds; but not until the advent of recent advanced hydraulic practices has it been possible to drill with water through certain formations in the West Texas area with sufficient speed to prevent sloughing. Scores of West Texas rigs are now setting new drilling records using essentially water as a drilling fluid.[8]

5. Lower bottom-hole pressure. Recent development work to take ultimate advantage of low-density drilling mud has produced techniques for using aerated mud and even straight air or natural gas as rotary drilling "fluid." Where low-pressure formations free of water flow are to be penetrated, phenomenal drilling speeds can be attained with the straight air or gas. For example, drilling speed was increased over 600 per cent in a Southwest Texas well when gas was substituted for drilling mud (Table 2)! In addition to the greater drilling speed, footage per bit was also increased substantially.

Comparative drilling-time curves for several other wells drilled with gas in the same area are shown in Fig. 2, plotted alongside curves on nearby wells drilled with mud. With the tremendous speed advantage offered by the new technique, it is not surprising that air or gas drilling is spreading rapidly to all drilling regions where conditions permit, and currently much air or gas drilling is being done in West Texas and New Mexico.[9]

Indications are that this newest adaptation of the rotary technique will spell the final word of doom for the old original "standard," or cable-tool rig, which has held what place it has in the drilling picture mainly by virtue of its ability to drill with reasonable efficiency under the very conditions where the rotary, now fed with air instead of mud, is setting new records.

6. Slim holes. Several of the previously mentioned drilling developments have contributed to the recent successful trend toward small-diameter holes under conditions of depth and formation problems which previously required the heavy-duty approach of larger drilling equipment. Humble Oil & Refining Co. reduced the cost of some 72 wells by 14 per cent in 1955 by trimming hole sizes. A portion of the saving, of course, came from a reduction in the diameter (and tonnage) of tubing and casing used, an advantage of increasing significance. The small-diameter, or "slim" hole is gaining in acceptance in all areas.

7. More efficient completion. A rather large amount of research and development in the broad fields of formation evaluation and well completion has been carried out by many oil operators, suppliers, and service companies. At least a portion of the charges

"With only these two factors in mind, increased average depth and a larger proportion of deep wells, it is reasonable to conclude that the cost of 72,000 wells in 1965 would approach 5 billion dollars."

for this work should be allocated to drilling since it has accounted for large reductions in total well costs in many instances.

Important examples of this research include perfection of the casing collar-radioactive log tie-in system of well-depth correlation; improved techniques and apparatus for formation logging, testing, and sampling; more efficient guns for casing perforation, some of which can be run through the well tubing, under pressure, if required; and newly found knowledge concering the effect of well-fluid properties at the time of perforation on well productivity.

8. Improved rigs. Finally, in the field of mechanics, considerable equipment research and product development on the part of dozens of suppliers and operators has provided important improvements in the over-all drilling machine, its accessories, its sources of power, and its means of power transmission. New and more efficient types of derricks, both fixed and portable, and improved rig-moving equipment have been made available from the same supply sources.

Significant advancements certainly have been achieved by the manufacturers of tubular goods. It is unfortunate from the standpoint of this report that there is no simple example to gage the increase in efficiency which these developments have contributed.

Effect of Research and Development

Thus, we see that the oil industry's research work for drilling, although scattered widely, has produced a long and impressive list of results. It is to the credit of good communications within the industry that nearly all of the results go into immediate and widespread use. In order to measure at least roughly the direct effect of this drilling research program, it is pertinent to examine the over-all performance of the drilling phase of the industry during the period when results of the program have been placed into operation.

Understandably, industry-wide cost information is not easily obtained. There are no regular and complete compilations of total well costs, which would be the most desirable gage of over-all efficiency of the drilling industry. Fortunately, however, we do have access to information on average well costs experienced by one company over a large-enough area that the data can be considered as reasonably typical of the industry as a whole.

Humble has drilled an average of 990 wells annually for the past 5 years in an area stretching from California to Florida along the southern borders of the United States. The bulk of these wells has been scattered rather uniformly by years throughout western New Mexico, Texas, and southern Louisiana, an area in which about one half of all United States wells has been drilled during the same period.

An actual rough check on the relevancy of the Humble cost data can be gained by comparing costs per foot for various depth wells (Fig. 3) with what are believed to be quite close estimates of United States average drilling costs for the year 1953 based on surveys conducted by the American Petroleum Institute, Independent Petroleum Association of America, and Mid-Continent Oil and Gas Association.[10] The cost data from the industry survey and the average Humble figures correlate quite closely with depth.

What Humble finds . . . Accepting the Humble data as representative, then, Fig. 3 shows a comparison of the total cost by depths of 816 onshore wells drilled in 1950 with 857 wells drilled in 1955. In spite of the fact that a drilling-cost "index" based on such cost factors as labor, material, equipment, and services increased 25 per cent* during the 5-year interval covered by comparison, the data show only a slight increase in the cost for shallow wells and an actual reduction in the cost of wells deeper than about 12,000 ft.!

As a matter of added interest and to isolate the effect of inflation, the cost data for 1950 are also plotted in terms of 1955 dollars; and the over-all improvement in drilling efficiency is shown in its true magnitude. On this basis of constant dollars, total well costs decreased from 10 per cent for 3,000-ft. wells to about 40 per cent for wells in the 15,000-ft. depth range over the 5-year interval.

In Fig. 4 an even sharper and almost startling comparison is gained by plotting a 1955 cost-depth curve for 125 wells drilled by Humble in the West Texas area only alongside a similar curve published for the year 1945.[11] Again, on a constant-dollar basis, extremely large cost reductions with time are noted for the deeper wells.

It seems obvious from consideration of the cost data presented that large-scale increases in drilling efficiency have occurred during the past 5 or so years. Furthermore, the substantial flattening of the cost-depth curves is vivid evidence that the industry is not only doing its over-all drilling job more efficiently, but it is also capable, in spite of inflation, of drilling deep wells today that would have been economic failures only 5 or 10 years ago. Many influences have contributed to the greater efficiency and the larger capacity of the drilling rig; but the dominate one, it is believed, is the industry-wide research and development effort.

Need for Additional Research

The question of adequacy of past expenditures for drilling research and development presents a problem with no exact solution. The knowledge that total well costs for a given depth of well have declined in terms of constant values, while encouraging, does not in itself spell out the answer we seek. But, as far as the proper level of **future** research expenditures is concerned, we have only to decide that our present base is reasonable, or desirable, or proper, and we can look to several indicators which are readily available for guidance.

Rising number of wells . . . If gross business is the proper gage, then all indications are that petroleum-industry activity in the fields of drilling research and development should increase steadily. Austin Cadle* has estimated that by 1965 the domestic industry will need to be drilling 61,000 wells annually.[12] However, if 1955's 56,000 wells against Cadle's estimated need for 45,000 wells that year is projected as a numerical difference, then we could expect nearer to 72,000 wells to be drilling in 1965.

Taking this number as the most likely, a simple projection of 1955 costs and depths and other conditions would mean a total industry well cost in excess of 3¾ billion dollars per year; and a proportionate increase in research expenditures would call for a composite annual budget of 13 million dollars (less

*The drilling index of reference is used by Humble Oil & Refining Co. and is made up of 13 well-cost items, 60 per cent of which on a value basis are composed of labor, well-head equipment, and tubular goods. The cost of these three items, in particular, has advanced more rapidly than the items which go to make up the better-known Consumer and Wholesale Price Indexes, which explains why the Drilling Index has advanced 25 per cent during a period when the Consumer's Price Index has advanced only 11.3 per cent.

*Manager of economics department, Standard Oil Co. of California.

offshore) in 1965. But these figures make no allowance for definite and long-established trends toward a larger proportion of very high-cost deep wells (deeper than 10,000 ft.) and toward greater and greater average well depths, not to mention yet to be firmly established trends offshore.

Deeper wells . . . For the matter of average well depth, a continuation of past trends is certainly to be expected and the average well of 1965 is likely to be 4,550 ft. deep. This factor alone would tend to increase costs by about 20 per cent.[10] And considering the effect of proportionately more deep wells, C. E. Reistle, Jr.,* estimates that by 1965 the number of wells deeper than 10,000 ft. will nearly double to more than 4,000 per year.[13] His information indicates further that the number of wells deeper than 16,000 ft. will increase sevenfold in 10 years to an estimated 332 in 1965.

With only these two factors in mind, increased average depth and a larger proportion of deep wells, it is reasonable to conclude that the cost of 72,000 wells in 1965 would approach 5 billion dollars. Should this prove to be the case, we would be looking to the need for a research and development expenditure for drilling of at least 16 million dollars annually, not including additional large expenditures which will probably be in order for specialized offshore equipment development projects.

What deserves attention . . . If it is not fully apparent that all signs point to the need and desirability of an accelerated drilling research program, then a brief mention of some of the many and significant technical problems which deserve attention should lend justification if not an actual incentive for greater effort:

. . . The chemistry and physics of drilling fluid need much investigation. This is the most direct approach to a host of problems of long standing—lost returns, stuck drill pipe, sloughing formations, plugging producing intervals.

. . . Basic operation of the rotary drill is still seeking an answer. The research that finds this answer will also explain why air, as a circulating fluid, drills six times as fast as water and why water drills faster than mud and why oil emulsified with mud drills faster than either oil or mud alone. It will tell, perhaps, how to treat mud to make mud drill as fast as air.

. . . The high cost of exploratory wells is associated with the difficulties and uncertainties of evaluating potential producing intervals. Continued large-scale research effort in the fields of electric logging, core analysis, and formation testing is certainly justified.

. . . Unnecessarily large pipe is a big cost factor. The low oil production of the average United States well (12½ bbl. per day in 1955) means that the average well utilizes but a fraction of the fluid-flow capacity of its tubing and casing. As a matter of fact, the casing is not used for producing purposes at all in most wells completed today.

Tremendous savings in drilling and well-material costs for many wells can be effected through the development of "slim slim-hole" drilling and producing techniques utilizing smaller rigs to set 4 or 4½-in. surface pipe with a 1½ or 2-in. oil string, and perhaps no tubing at all as we know it today.

. . . Extended bit life has a value increasing exponentially with depth. For this reason, if for no other, mechanical research and development on drilling tools of all types is yet a rich field of investigation. Several companies are experimenting with down-the-hole driving mechanism, and outstanding results[14] have been claimed in some instances although much additional work will be required to perfect these new drills. Out of this work it is hoped will come solutions to the problems of hole deviation which have plagued drillers since the inception of rotary and cable-tool drilling as well.

. . . Use of air or gas as the circulating medium produces such phenomenal rotary drilling results that additional development work to extend this method to as many areas as possible is obviously desirable. In particular, solution of the water-shutoff problem would greatly broaden the application of air and gas drilling and deserves much immediate attention.

. . . The equipment field contains many areas of needed improvement such as the continual demand for higher-strength drill pipe, casing, tubing, and wellhead apparatus as the development of drilling techniques permits greater and greater well depths. A critical equipment deficiency of long standing is the unsatisfactory life of the fluid-end components for high-pressure slush pumps. The frequent failure or rapid wear of these critical items results in high rig-maintenance costs and is essentially the reason for large investments in standby equipment in many instances.

. . . Development of offshore leases needs a great amount of research and development. Entirely new methods and apparatus for drilling deep wells from floating platforms and completing wells at the ocean floor will certainly be required if the full exploration possibilities of the Continental Shelf are to be realized.

"For the drilling industry, an acceptable minimum (for drilling research) of 1 per cent of gross business would amount to about 30 million dollars annually at current levels of activity, or about three times . . . the amount being spent."

*President, A.I.M.E.; vice president, Humble Oil & Refining Co.

References

1. Pogue, Joseph E., and Hill, Kenneth E.: Future Growth and Financial Requirements of the World Petroleum Industry, Chase Manhattan Bank.

2. Comparative Statistics in the Drilling Industry for 1955, The Drilling Contractor, Feb. (1956).

3. Thompson, A. W.: Is Drilling Research Keeping Pace With Other Industry Achievements? World Oil, Oct. (1955).

4. The Age of Research, Time, July 9 (1956).

5. Nolley, J. P., and Eckel, John R.: An Analysis of the Hydraulic Factors Affecting the Rate of Penetration of Drag-Type Rotary Bits, Drilling and Production Practice, 9 (1949). See also Dodge, N. L., Atkinson, J. E., and Sedor, J.: Deep-Well Drilling, Weeks Island, Louisiana, through 1954, Proc. American Petroleum Institute, Sect. IV (Prod. Bul. 241) 63 (1955) and The Oil and Gas Journal, April 11, 1955, p. 100.

6. Payne, Lyle L.: Improved Rock Bit Lowers Drilling Cost in Hard Abrasive Formations, The Oil and Gas Journal, Sept. 29, 1952, p. 226.

7. Wardroup, W. R., and Cannon, George E.: Some Factors Contributing to Increased Drilling Rate, presented at Spring Meeting of Southwestern District, A.P.I. Division of Production, March 1956, The Oil and Gas Journal, April 30, 1956, p. 204.

8. Bell, J. S.: How Modern Drilling Muds Affect Rate of Penetration in Oil Drilling in West Texas and New Mexico, The Oil and Gas Journal, Oct. 19 (1953).

9. Brantly, M. M., and Smith, F. W.: Air Drilling Is Developing Rapidly, World Oil, June (1955).

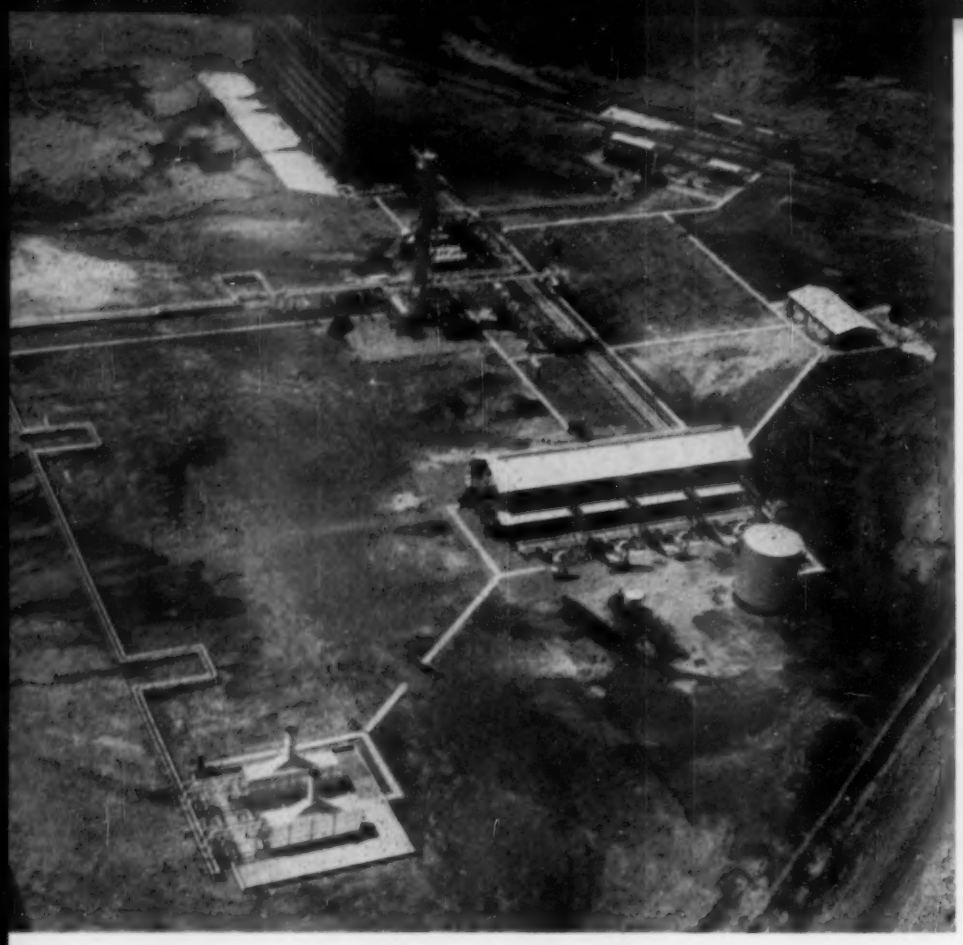
10. U. S. Drilling Cost, World Oil, Feb. 15 (1956).

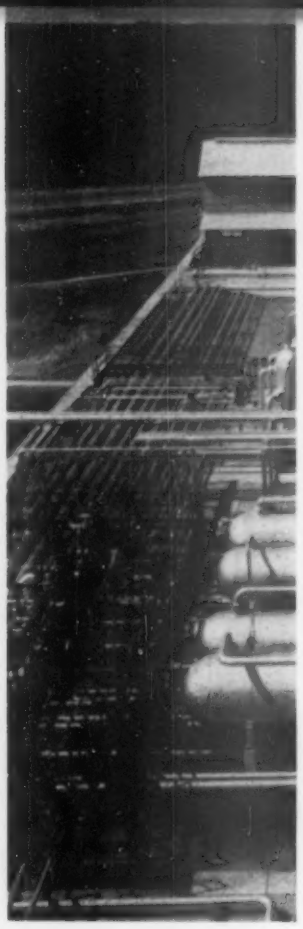
11. Ragland, Douglas: Drilling Equipment Needs, presented at 1946 Conference on Petroleum Mechanical Engineering, Petroleum Committee of A.S.M.E., Oct. 1946, and The Oil and Gas Journal, Oct. 12, 1946, p. 99.

12. Cadle, Austin: Future Energy Demand and Supply, Proc. A.P.I., Sect. VI, 76 (1955).

13. Reistle, C. E., Jr.: How Deep Can We Go? presented at Houston Chapter of A.I.M.E., April 1956.

14. Gronemeyer, Wilhelm: Increase in the Drilling Efficiency by Use of Drilling Turbine, Special Imprint from "Bergbauwissenschaften" 2, 1955, No. 5.





Gas Cycling Yields 10,600 Bbl. Daily for

Mene Grande is operating a huge gas-cycling plant to recover some 87.5 million barrels of condensate from two Venezuelan reservoirs. Gas throughput is 125 M.M.c.f. per day with dry gas being returned to the reservoirs at a top-hole pressure of 2,400 psi. to maintain the reservoir fluid at its dew point.

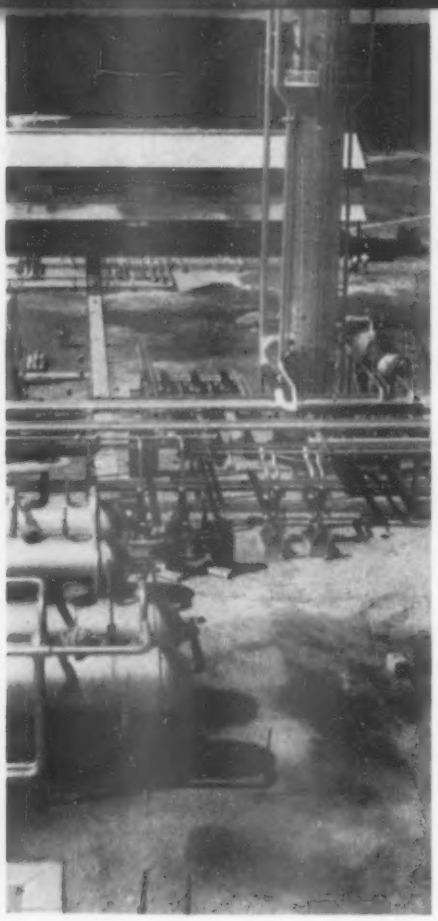
IN eastern Venezuela, condensate reservoirs have been of little interest because of the lack of a gas market. Mene Grande Oil Co. has found through an extensive study of Santa Rosa field, however, that cycling of dry gas at the beginning of production will pay off handsomely for at least two condensate reservoirs. In these two reservoirs, the Colorado E and G sands, cycling at dew-point pressures will recover at least 87.5 million barrels of white oil, nearly twice that recoverable by pressure depletion.

At the time of the original reservoir study in 1953 the recoverable reserves were estimated to be about 30 million barrels. The cycling plant built for this recovery was designed for straight-stage separation of 104 M.M.c.f.d. of reservoir gas but has been enlarged to handle 125 M.M.c.f.d. Oil recovery with this throughput is 10,600 bbl. per day. Current development drilling has greatly increased recoverable reserves and cycling facilities are now being expanded. Plans call for doubling the present size of the plant.

FIELD PROCESSING

Besides these condensate reservoirs Santa Rosa field has a number of black-oil reservoirs to provide high-pressure makeup gas. Current production of black oil is over 7,000 bbl. per day.

In contrast to black-oil producers, the condensate zones are produced at very high rates into separators through adjustable chokes. The production rates are determined only by the back pres-



Extreme left:

WHITE-OIL PLANT recovers 10,600 bbl. condensate daily from a gas throughput of 125 M.M.c.f. Gas from the stage separation is returned to the reservoir at 2,400 psi. by four 1,320-hp. compressors.

Left:

FOUR-STAGE SEPARATION and stabilization is used for white-oil recovery. Reserve estimates have been continually upward and present plans call for doubling plant capacity, adding 5,300 hp. and including L.P.G. recovery units.

Mene Grande

by Kenneth E. Hard

and

Jack R. Wiewall

sure of the separation system, except in cases where an attempt is made to help the pattern efficiency.

To maintain the desired production rates from the Colorado E and G sands, four 1,320-hp. compressors have been installed. Twelve producers were provided initially. Three or four dual-zone injection wells will handle the entire output from three 1,320-hp. compressors. In view of development of additional reserves, however, six injection wells each completed in a single zone were installed initially.

Geology

Santa Rosa field is located in the central part of the eastern Venezuela basin. The field is grouped with El Toco, Santa Ana, San Roque, San Joaquin, and El Roble under the general name of the Anaco fields.

Oil and gas accumulation in Santa Rosa is controlled primarily by the domal structure, while faulting or sand development plays a secondary role. Sand lenticularity is common, and objective sands may completely disappear from one location to another. The field, as shown on the maps, Figs. 1 and 2, is an alongated dome with its major axis oriented in a northeast-southwest direction. At San Joaquin and Santa Ana fields the structure apparently overlies the northwest-dipping Anaco thrust, but this major feature has not yet been encountered in Santa Rosa.

Paralleling the major axis, a southeast-dipping reverse fault cuts the Oficina sediments repeating a maximum of 250 ft. of section. As shown in Fig. 1, this reverse fault, which dies out before reaching the surface, has a dip of approximately 47° at shallow horizons, flattening to about 35° with depth. The southwestern extension of the fault has not been determined, but to the northeast it terminates before reaching the crest of the structure. Three normal faults have been encountered with their strike generally from the known periphery toward the crest of the dome. These faults probably terminate before reaching the apex of the dome.

TABLE 1—COLORADO E SAND—STATISTICAL SUMMARY, JULY 1, 1953

Reservoir characteristics:	
Depth:	
Average subground, ft.	8,450
Average datum (ss.), ft.	7,700
Porosity, per cent	15.5
Permeability, md.	235
Interstitial water, per cent	20
Temperature, °F.	255
Present pressure, psi. at 7,700 ft.	4,437
Lithology: Sandstone, fine-grained, well-sorted, hard massive, somewhat quartzitic.	
Character of oil:	
Gravity, °A.P.I.	50
Producing GOR, cu. ft. per bbl.	10,000
Reservoir viscosity, cp.	0.06
Dew point (present), psig. at 7,700 ft.	4,437
Size of gas column:	
Net sand thickness, ft.	36
Surface area (acres)	4,982
Acre-feet	179,638
Barrels of oil per acre-foot	145
Stock-tank oil in place, bbl.	26,050,000
Oil recovery:	
Efficiency, per cent	75
Recoverable stock-tank oil by cycling, bbl.	21,455,000
Recovery by blowdown after cycling, bbl.	1,870,000
Total recoverable oil by cycling and blowdown after cycling, bbl.	23,325,000
Recoverable oil by pressure depletion, bbl.	10,100,000

Reservoir Studies

The Colorado E and G reservoirs were selected for initial cycling based on well tests, sufficient richness of gas, and reasonable values of permeability. Selection was also greatly influenced by the large volumes of the two reservoirs and more detailed reservoir information, particularly core analysis and producing characteristics. The Merecure group was excluded because of limited data and lack of outlets. As more information becomes available, other sands in the Santa Ines and Merecure groups will also be studied for cycling prospects.

The geological information on the Colorado E and G sands is somewhat limited because of the wide spacing in these horizons and lack of closure. Determining proven and semiproven reservoir volumes, arbitrary boundaries were used. These boundaries are believed to be conservative because of

THE AUTHORS

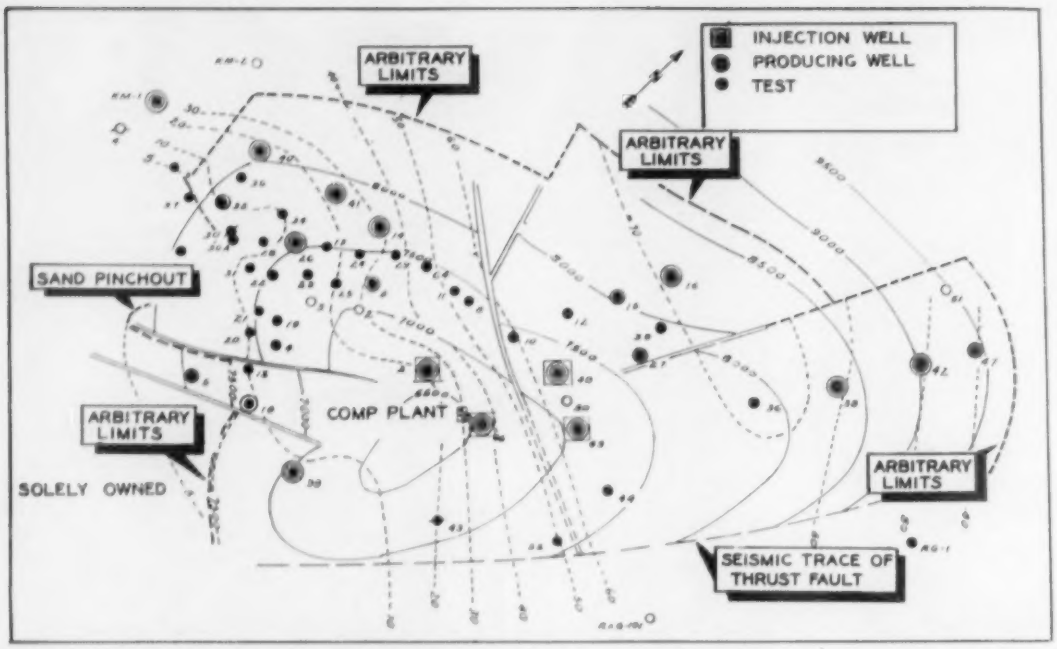
K. E. HARD

J. R. WIEWALL

Kenneth E. Hard is superintendent of the production department of Mene Grande Oil Co. He joined Meneg in 1952 as reservoir engineer following a tour of duty with Magnolia Petroleum Co. Hard holds a B.E. in petroleum engineering from University of Southern California.

Jack R. Wiewall is district gas engineer for Mene Grande Oil Co., a position he has held since 1954. A B.E. in mechanical engineering, Yale University, Wiewall worked with Creole Petroleum Corp. for 2 years, and worked with Otis Pressure Control Co. for a year. He joined Meneg as petroleum engineer in December 1950, and was transferred to the gas department in September 1952.

This article was presented as a paper at Gulf Oil Corp.'s engineering conference, Pittsburgh.



COLORADO E SAND of Santa Rosa field is outlined by this map of the depth contours and the net-sand isopachs. Boundaries are formed by sand pinchout and faults. Stepouts have trebled reserve estimates since 1953. Fig. 1.

the characteristic lenticularity of sands in the field.

The indicated fault pattern will have no large effect on the cycling programs if the faults terminate prior to reaching the crest of the structure; such fault patterns might aid the cycling program because of ability to cycle the reservoir in segments from the injection wells. However, the fault pattern could be detrimental to the cycling program if the normal faults complete-

TABLE 2—COLORADO G SAND—STATISTICAL SUMMARY, JULY 1, 1953

Reservoir characteristics:			
Depth:			
Average subground, ft.			8,750
Average datum (ss.), ft.			8,000
Porosity:			
More permeable section, per cent			17.4
Tight section, per cent			13.4
Permeability:			
Permeable section, md.			1,250
Tight section, md.			175
Interstitial water:			
More permeable section, per cent			15
Tight section, per cent			25
Temperature, °F.			260
Present pressure, psi. at 8,290 ft.			4,400
Lithology		Sandstone, fine-grained, well-sorted	
Character of oil:			
Gravity, °A.P.I.			50
Producing GOR, cu. ft. per bbl.			10,000
Reservoir viscosity, cp.			0.05
Dew point (present), psig. at 8,290 ft.			4,400

Size of gas column:	Permeable section	Tight section	Total
Net sand thickness, ft.	13.75	12.40	26
Surface area (acres)	3,509	3,509	3,509
Acre-feet	48,323	43,491	91,814
Barrels of oil per acre-foot	169	115	143.5
Stock-tank oil in place	8,170,000	5,000,000	13,170,000

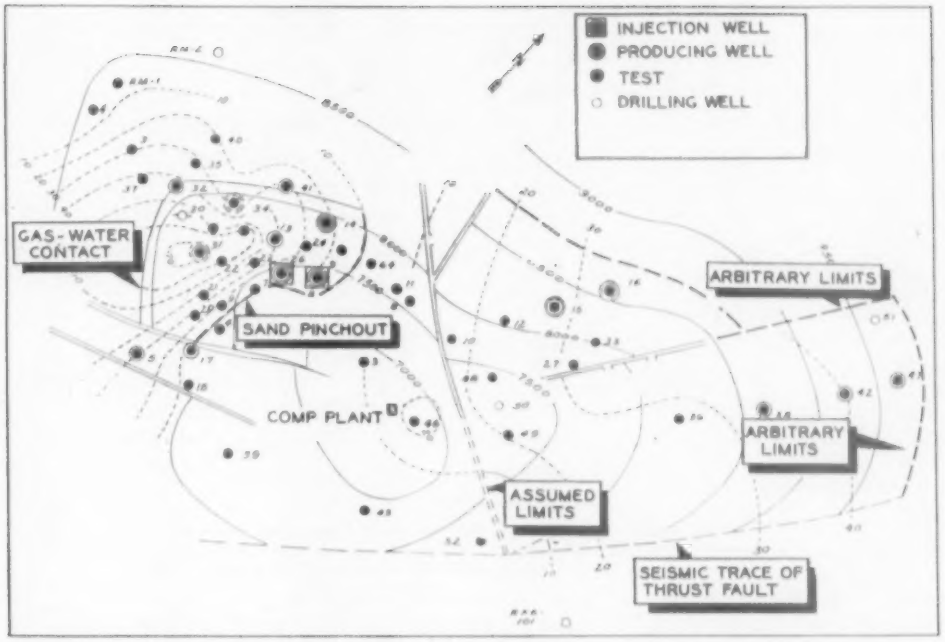
Oil recovery:	
Probable pattern efficiency, per cent	75
Recoverable stock-tank oil by cycling, bbl.	9,044,000
Recoverable stock-tank oil by blowdown after cycling, bbl.	1,070,000
Total recoverable stock-tank oil by cycling and blowdown after cycling, bbl.	10,114,000
Recoverable stock-tank by pressure depletion, bbl.	5,640,000

TABLE 3—HYDROCARBON ANALYSIS, COLORADO E SAND, SANTA ROSA FIELD

	Composition, mole per cent—		
Component—	Sep. gas	Sep. liquid	Reservoir fluid
Methane	72.96	5.31	68.82
Ethane	11.40	3.07	10.32
Propane	6.34	6.40	5.79
Isobutane	1.35	3.08	1.09
n-Butane	2.26	6.04	1.69
Isopentane	0.21	4.31	1.53
n-Pentane	0.34	3.59	0.60
Hexanes	0.23	7.48	0.75
Heptanes plus	0.41	60.30	5.72
Carbon dioxide	4.50	0.42	3.69
Total	100.00	100.00	100.00
Sp. gr. of C_7+	0.6710	0.7486	
Average mole weight of C_6+ (estimated)	90.38	123.3	

TABLE 4—HYDROCARBON ANALYSIS, COLORADO G SAND, SANTA ROSA FIELD

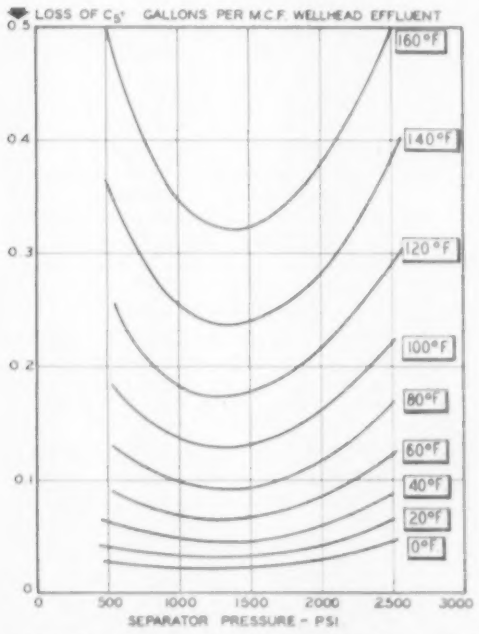
	Composition, mole per cent—		
Component—	Sep. gas	Sep. liquid	Reservoir fluid
Methane	77.63	1.93	68.82
Ethane	10.92	6.10	10.32
Propane	4.91	13.23	5.79
Isobutane	0.71	4.21	1.09
n-Butane	0.84	8.68	1.69
Isopentane	0.20	6.57	1.53
n-Pentane	0.20	3.78	0.60
Hexanes	0.23	4.92	0.75
Heptanes plus	0.24	50.09	5.72
Carbon dioxide	4.12	0.49	3.69
Total	100.00	100.00	100.00
Sp. gr. of C_7+	0.671	0.729	
Average mole weight of C_6+ (estimated)	90.38	134.8	



COLORADO G SAND lies below the E sand at Santa Rosa and both lie below black-oil sands. Major structural features are the same but the depth contours and net-sand isopachs are different. Many of the producing wells are dually completed. Fig. 2.

ly divide the dome into several segments, since additional injection and production wells would be required for the same recovery of oil.

The possibility of a black-oil leg downdip in these sands has not been overlooked. The injection wells are located near the apex of the dome and the condensate producing outlets above the possible gas-oil interface. By the time the initial condensate wells go to dry gas, the downdip limits of the reservoir should be determined. Ample rich gas will still be available to flush the black-oil zone, to be followed with dry gas after these producers have gone to condensate.



LOSS of pentanes and heavier in gas leaving the inlet separator. Operation is at 2,400 psi. but gas is cooled to 95° F. Fig. 3.

Characteristics . . . Structure contour and net-sand isopachs for the Colorado E and G sands are shown in Figs. 1 and 2. The Colorado E and G are well developed sheet sands with the most continuous development in the Santa Rosa field. The sands are present in all wells drilled into the horizon with varying thickness from 5 to 75 ft. The average thickness of the Colorado E sand is 36 ft. and the Colorado G sand is 27 ft.

The limits of reservoirs were chosen by downdip oil or condensate test, the 10-ft. net sand isopachs, normal faults, and the seismic trace of the thrust fault. The productive limits of the sands are being extended with stepout drilling in the areas beyond the arbitrary limits.

The lithology of the Colorado E sand is characterized by a fine-grained, well-sorted, hard, massive, somewhat quartzitic sandstone. The average permeability of this sand from the cores available is 235 md. and the average porosity is 15.5 per cent. An interstitial water saturation of 20 per cent is estimated from data available for another field nearby. Table 1 summarizes the reservoir data.

Two sand types are present in the Colorado G sand. The upper sand is much tighter than the lower. Table 2 summarizes the properties.

Fluid . . . The Colorado E sand has produced from well RG-14 for 3.5 years, and test data from this well are probably fairly representative of the producing characteristics of this sand. The average gravity of the oil from 10 tests during 1953 is 49.2° A.P.I. The average gas-oil ratio from five tests during 1953 is 10,500 cu. ft. per bbl. Results of a hydrocarbon analysis of the gas and liquid are presented with the calculated composition of the reservoir gas in Table 3. Using the psuedo-critical temperature and pressure of the reservoir gas, the gas deviation factor (z) was determined to be 0.913 at the initial reservoir pressure.

The Colorado G sand has been produced since February 1950. The first completion, well RG-15, indicates production of black oil with varying amounts of condensate. The well was completed with a gas-oil ratio of 3,200 cu. ft. per bbl. and a gravity of 37.5° A.P.I. The gas-oil ratio decreased steadily for 2 months to a minimum of 1,800 cu. ft. per bbl. and the gravity remained constant. After reaching this

minimum gas-oil ratio, it increased steadily to 5,000 cu. ft. per bbl. and the gravity increased to 43° A.P.I. by August 1950. Since August 1950 well RG-15 has produced with fairly consistent gas-oil ratios of 5,000 to 7,000 cu. ft. per bbl. and with gravities from 40° to 43° A.P.I.

The initial completion of well RG-16 indicates a black-oil phase similar to well RG-15. However, well RG-16 produced very little black oil and went to condensate almost immediately after completion. The zone tested 17.0 per cent water during a workover in November 1951 and was squeezed off.

A possible explanation of the production history exhibited by well RG-15 is the Colorado G sand contains a highly compressible fluid which with a change in pressure can be either a high-pressure gas or black oil. This type of fluid investigated previously by Weinaug and Bradley[4] is probably very near the critical conditions, and has an S-shaped formation-volume-factor curve. This fluid may show up to 50 per cent shrinkage with a small pressure drop (200 psi. ± 100 psi.) from initial conditions. The fluid could be a 100 per cent "liquid" phase near its critical conditions, and with an extremely small pressure drop (100 psi.), change to as low as 30 per cent liquid which is very near the residual-oil saturation.

This possible oil leg in the Colorado G reservoir can be treated as condensate since the recoveries would probably be similar under a cycling program. If a liquid phase exists the initial formation volume factor is probably very large, and without maintenance recovery will be poor.

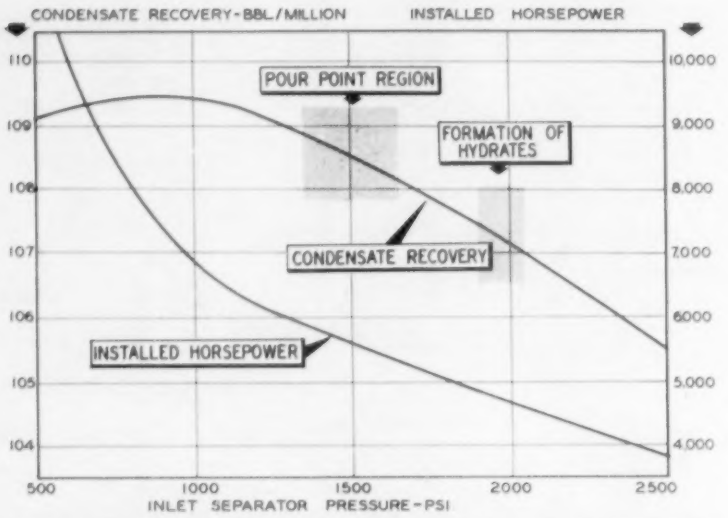
The fluid characteristics for the Colorado G sand area are based on limited test data. A hydrocarbon analysis of the separator gas and liquid taken while well RG-14 was producing, on a drill-stem test, from the Colorado G sand is presented in Table 4 with the calculated composition of the reservoir gas. Using the pseudocritical temperature and pressure of the reservoir gas, the gas deviation factor (Z) was determined to be 0.920 at initial reservoir pressure.

Recoverable oil . . . Based on proven and semiproven acreage as of July 1, 1953, volume for the Colorado E reservoir was 179,640 acre-ft. Using the gas-deviation-factor, the initial pressure of 4,437 psi., and the reservoir temperature of 255° F., the gas-formation volume factor is calculated as 241 std. cu. ft. per reservoir cubic foot. Expressed in standard cubic feet of gas per acre-foot, with an average porosity of 15.5 per cent and an interstitial-water content of 20 per cent, the gas-formation volume factor is 1.302×10^6 std. cu. ft. per acre-foot. Based on ideal separation, the initial stock-tank oil is 111.5 bbl. per M.M.c.f. of produced reservoir gas. For the sand volume the initial stock-tank oil in place is 145 bbl. per acre-ft. and for the proven and semiproven portions of the Colorado E sand is 26,050,000 bbl. Recovery by cycling and blowdown is 23,325,000 bbl. These calculations are summarized in Table 1.

For the Colorado G sand which consists of two sand types, one more permeable and homogeneous than the other, reservoir volumes of the proven and semiproven area in July 1953 are as follows:

Sand Type	Acre-Ft.	Per Cent
More-permeable	48,323	50
Tight	43,491	45
Nonproductive	4,832	5
	96,646	100

Using the gas deviation factor, the initial pressure of 4,400 psi. and the reservoir temperature of 260° F., the gas-formation volume factor is 235.8 std. cu. ft. per reservoir cubic foot. This is 1.031×10^6 std. cu. ft. per acre-ft. for the tight sand and 1.519×10^6 std. cu. ft. per acre-ft. for the more permeable sand. Table 2 summarizes these data and shows calculated oil in place and oil to be recovered by cycling.



SEPARATOR PRESSURE on the inlet stage determines condensate recovery and amount of horsepower needed. Although recovery is higher at the lower pressures the pour point places a practical limit on the temperatures and pressures. Fig. 4.

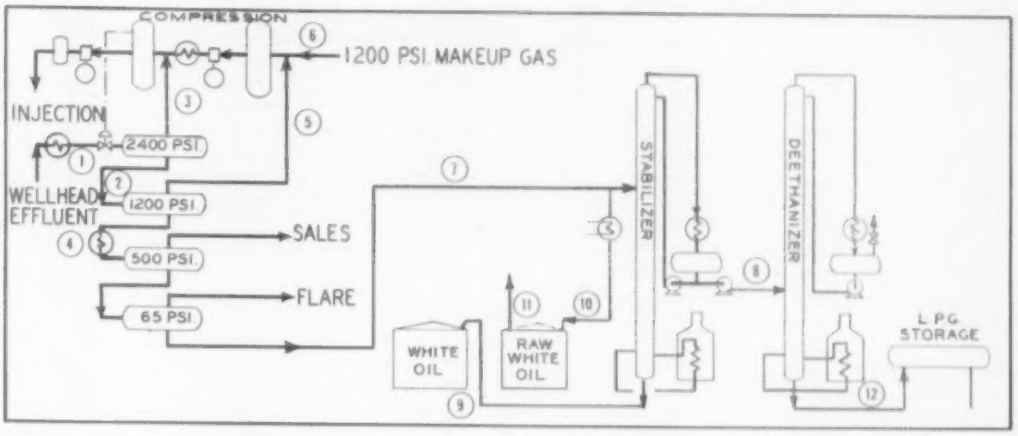
Plant, Field, and Well Facilities

Generally, the principal considerations which govern the sizing and selection of the facilities for a cycling project are determined by the economic balance struck between the type of cycling program, the number of wells, producing rates, the size of the reservoir, and the existing market for the products. In the case of Santa Rosa, as with many other cycling projects, most of the principal variables had been fixed by existing conditions. The lack of a dry-gas market and the large volume of gas available from black-oil reservoirs in the field favor a dew-point cycling program.

Wells nearing depletion in the other reservoirs of the field which could be recompleted in the Colorado E and G reservoirs, eliminated the necessity to drill new outlets. The maximum producing rates for the wells will determine the length of time to produce the reservoir. This consideration was the most important factor in determining the size of the initial facilities. In addition the reserves were being increased with each stepout well and once the productive limits of the reservoirs were determined, the plant capacity would have to be increased in order to cycle the reservoir within the desired period of time. In view of this, it was evident that the most economical size of the initial facilities would be that which would permit the highest allowable well rates. The last factor to be considered, the market for the products, indicated the type of facilities. Presently there is a market for the white oil only; no market exists for L.P.G. or dry gas.

The type and size of the initial facilities were resolved by election to cycle the reservoir at the dew point and extract the white oil from the wellhead effluent. In conjunction with the compressor plant for returning the gas, three different processes considered were straight stage separation, low-temperature separation, and absorption.

. . . Straight stage separation (see Fig. 5) was investigated first as the simplest and most flexible method suitable for



Description—	1	2	3	4	5	6	7	8	9	10	11	12
Carbon dioxide	4.10	3.53	4.41	3.07	4.73	2.56	0.86	1.24	0	0.53	1.80	0
Methane	66.25	43.30	78.79	29.22	80.33	82.19	2.46	2.66	0	1.41	4.87	0
Ethane	10.57	12.42	9.55	13.42	9.79	8.78	9.10	22.63	0	6.93	22.05	1.03
Propane	6.35	10.16	4.27	12.68	3.55	4.20	15.95	55.67	0.13	14.96	38.23	72.29
Isobutane	1.52	2.88	0.78	3.77	0.53	0.69	5.74	10.61	4.60	5.78	10.03	15.56
Normal butane	2.63	5.22	1.21	6.92	0.75	1.06	11.02	7.19	13.79	11.29	16.92	11.12
Isopentane	0.62	1.38	0.21	1.86	0.10	0.17	3.17	0	4.71	3.35	2.33	0
Normal pentane	0.66	1.51	0.20	2.05	0.09	0.13	3.53	0	5.25	3.76	2.07	0
Hexane	0.95	2.37	0.18	3.24	0.06	0.09	5.73	0	8.52	6.16	1.06	0
Heptanes plus	6.35	17.23	0.40	23.77	0.07	0.13	42.44	0	63.00	45.83	0.64	0
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Volume, M.c.f.d.	104,500					21,600					4,000	
Flow, bbl. per day									10,700			1,440

PLANT SEPARATION SYSTEM employs straight-through separation. At present only the stabilizer is operating but the deethanizer is planned. Fig. 5.

the earlier stages in the development of the field. Preliminary calculations revealed that the pressure and temperature of the first stage were the governing factors for efficient separation. Fig. 3 shows the influence of pressure and temperature on separation.

Reservoir considerations dictated a lower limit of 2,500 psi. for the producing wellhead pressures which fixed the first-stage pressure for straight stage separation at 2,400 psi. At this pressure the producing wellhead temperature was approximately 160° F., therefore, in order to improve the liquid recovery it proved extremely profitable to precool the entire wellhead effluent before separation to approximately 95° F. Further studies placed the subsequent stages of separation at 1,200, 500, 150 psi. and thence to a stabilizer.

The desirability of having a stabilizer was indicated as the stock-tank oil from straight stage separation would have a Reid vapor pressure of approximately 22.0 psi. which would be subject to a pipeline tariff besides having high filling and weathering losses. The stabilizer will produce a crude to meet the pipeline tariff regulations and also increase the plant production.

. . . **Low-temperature separation,** next considered, utilized precooling of the wellhead effluent and expansion of it from 2,400 psi. to some lower pressure with a subsequent cooling effect. The liquid from this stage, flashed at 500 and 150 psi., stabilized to a 12.5-psi.-R.v.p. product. The recoveries by this process and by straight stage separation plotted versus the first separation pressure are shown in Fig. 4. Shown on this curve are the regions where gas hydrates will form and the pour point of the oil. The pour point places a lower limit on the pressure and temperatures at which the first stage can be operated.

The required horsepower to inject sufficient gas to cycle the reservoir at its dew point and to deplete the known reserves within the life of the concession versus inlet separated pressure is shown in Fig. 4.

. . . **The third method** was the separation of the wellhead effluent at 1,800 psi. and the processing of this gas along with gas from some of the lower stages through absorption facilities. However, in view of the high liquid-recovery efficiencies obtained by the first two methods, the lack of a market for L.P.G. and the estimated cost of the absorption facilities showed this method uneconomical.

The final decision was to proceed with a plant designed to stage separate the wellhead effluent at 2,400 psi. with provisions for lowering the first-stage separation pressure. The field is still being developed and the productive limits are not known, which favors this type of plant representing the most flexible design and requiring the least investment. The estimated efficiency of the liquid recovery by straight stage separation is approximately 95.8 per cent versus 98.3 per cent for low-temperature separation at 1,200 psi., the most efficient pressure.

Plant design . . . With the selection of the final process flow and the preliminary sizing of the plant facilities, specifications were drawn up and a contract awarded for the design of the cycling plant. These specifications called for a plant with straight stage separation at 2,400 psi., but with provisions for lowering the pressure, for low-temperature operations, and capable of handling approximately 104 M.M.c.f.d. of reservoir fluid. At this producing rate, the plant production would be about 10,000 bbl. per 24 hours of a stabilized white oil having a gravity of 60° A.P.I. and a Reid vapor pressure of 12.5 psi. Recently, these rates have been increased to 125 M.M.c.f.d. and 10,600 bbl. per day. Plans call for doubling these rates in the future.

All of the wells are produced to the plant through flow lines to a common manifold. At the manifold each flow line is equipped with an adjustable choke for controlling the producing rate and an orifice meter for obtaining factors for production allocation. Each flow line is also manifolded to a test separator capable of withstanding the full wellhead pressure. The wellhead

effluent will be separated in the test separator and both the liquid and gas streams metered and then recombined with the main production stream to the plant. Well testing by this method allows simple periodic checking of gas-oil ratios and allocation of the production without upsetting the plant and eliminates the necessity of making well tests in the field.

From the incoming manifold the total production stream flows through cooling coils in an atmospheric cooling tower and then through a diaphragm-operated motor valve. The diaphragm motor valve is actuated by the pressure in the gas scrubber following the first stage of separation so that should any compressor, or compressors, go down the valve will regulate the flow accordingly, shutting in the field if necessary, and prevent the flaring of gas.

After passing through the diaphragm motor valve the total production stream flows to the first-stage separator operating at 2,400 psi. From the primary separator the white oil flows through three subsequent stages of separation at 1,200, 500, and 100 psi. Between the 1,200 and 500-psi. stages of separation it is necessary to heat the white oil before expansion to keep the temperature of the liquid above the pour point.

From the last separation stage the white oil is pumped to the stabilizing column operating at approximately 355 psi. This column is 7 ft. in diameter by 80 ft. high, contains 40 bubble-cap trays, and is designed for processing approximately 11,000 bbl. of white oil per day. Initially, only a sufficient quantity of stabilizer overhead will be condensed to meet reflux requirements. However, in the near future it is proposed to condense all of the stabilizer overhead and store the excess in a partially depleted reservoir.

The bottom product from the tower, a depropanized condensate, is cooled in the natural-draft atmospheric type of cooling tower and stored in two 15,000-bbl., cone-roof storage tanks. From the plant, the white oil is pumped approximately 6 miles to the Anaco tank farm for blending and reshipment to the marine terminal facilities at Puerto la Cruz.

Gas injection . . . The gas from the second-stage separator operating at 1,200 psi. is combined with the 1,200-psi. makeup gas stream from the field, is scrubbed and compressed to 2,400 psi. This gas is then cooled and combined with the gas from the first-stage separator operating at 2,400 psi., and this gas is compressed to between 4,000 to 4,600-psi. pressure required for injection. The gas from the last stage of compression is scrubbed to remove any lube oil or foreign matter which might contaminate the sand face of the injection wells.

The gas to be injected into each well is controlled and metered through an injection manifold at the plant and delivered to each well through individual injection lines. The gas from the 500 and 100-psi. stages flared with the exception of that part which is either sold or utilized for fuel and instrument operation.

The plant has been instrumented to provide a high degree of safety and automation. All of the vessels are equipped with the normal alarms, shutdowns, and relief equipment as required by the U.S.A. codes. Besides the normal shutdowns, two remotely located controls have been installed by which the entire plant can be shut down if necessary. In the event that the plant is shut down for any reason, the main diaphragm-control valve on the total incoming production stream will close in the field. All of the alarms and shutdowns have warning lights on a central-control panel in the compressor building and actuate an audible alarm.

The water for the plant is piped from a central water-treatment plant in the Santa Rosa area. Electric power is supplied from the nearby central company generating facilities. All of the process and service pumps are driven by electric motors.

Field system . . . Concurrently with the design of the plant, the layout of the field system was being planned. To supply the plant with 104 M.M.c.f. per day, 12 wells were provided initially in the Colorado E and G reservoirs. The original selection of outlets was modified as the development program progressed and as additional wells were made available. In equipping these wells as condensate producers these completion practices were followed:

1. Practically all of the wells were capable of producing black oil from one or more of a series of structurally higher sands. In view of this and the fact that the wells were primarily being drilled for black oil, dual completions were made with the black-oil sands to produce through the tubing. In all cases, regardless of whether or not it was possible to make a dual completion, the condensate sand is to be produced through the tubing.

2. All wells which will be used as condensate producers are equipped with chrome-alloy steel tubing with Hydril joints and a chrome-steel wellhead. In the older wells completed with 5½-in. casing, 2½-in. tubing was run. In the newer wells completed with 7-in. casing, 4-in. tubing was run to reduce flow string losses. The use of chrome-alloy tubing and well-control heads was adopted because of corrosion considerations.

3. Included in the wellheads of all the producing wells as an added safety feature is an excess flow valve between the two master valves.

4. To protect the carbon-steel flow lines and the plant, an inhibitor is injected at each wellhead.

Designing the field gathering system, it was decided to lay individual flow lines from each well to the plant. This program was extremely flexible and could easily be adapted to the changing field conditions. This program also made possible individual well controls in the plant with central test facilities thereby reducing the field labor force.

The gas-injection system consists of six welded steel high-pressure lines each of which is connected individually to an injection well. All of the injection wells are single-zone completions with the sand to be cycled completed in the tubing. The well-control heads and tubing for these wells are carbon steel.

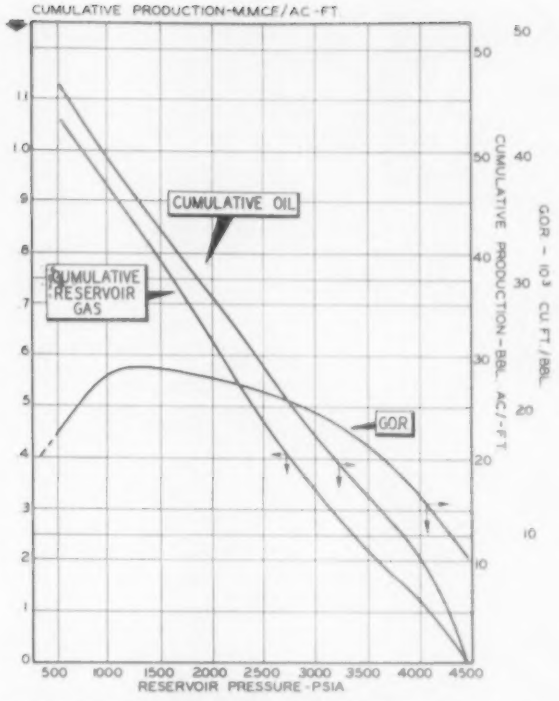
SANTA ROSA CYCLING PROJECT—2

How Engineering Calculations Were Made for Project

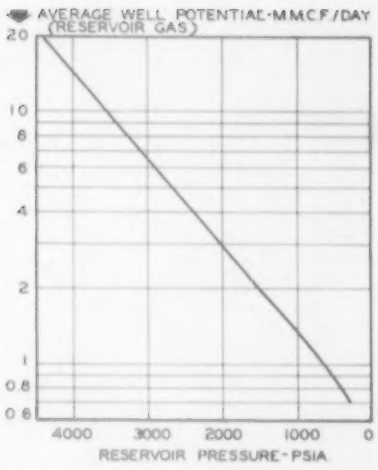
PRESSURE depletion performance of the Colorado E and G reservoirs in Santa Rosa field was calculated using equilibrium constants and normal material balances. The results of these calculations are as shown in Fig. 6, which shows performance of the E sand reservoir as a function of pressure.

No fluid-behavior analysis or model reservoir study is available on the fluid of either of the reservoirs. Therefore this study necessitated the construction of equilibrium constants of the fluid components versus pressure as described by Standing.[1] For the Colorado E sand the assumption was made that initially it contained a fully saturated gas and the dew-point pressure was equal to the bottom-hole pressure of 4,450 psi. The conditions of the G sand reservoir are quite similar.

Well potentials as a function of the



PREDICTED PERFORMANCE of the Colorado E Sand reservoir as a function of reservoir pressure with pressure being depleted. Final conclusions were to cycle at dew point. Fig. 6.



WELL POTENTIAL varies with reservoir pressure as shown for wells with 4-in. tubing. Fig. 7.

reservoir pressure were calculated from the work by Buthod and Whitely.[2] The flow of gas in a vertical pipe is given by the equation:

$$P_B^2 = B\,(P_T^2 + A) - A$$

Where:

$$B = e^{0.376\,sd/zT}$$

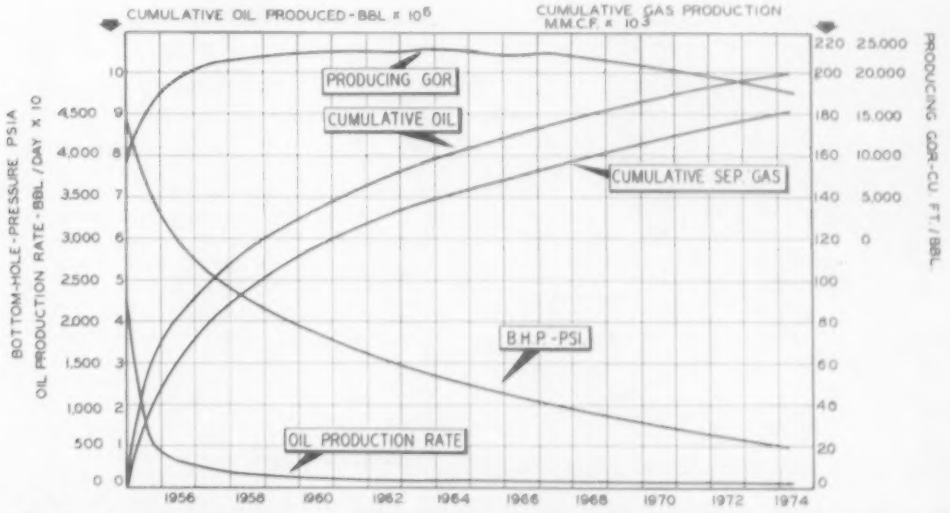
$$A = \frac{15.1 \times 10^{-6}\, z^2\, T^2\, Q^2}{D^{5.23}}$$

P_B = pressure at well bottom, psia.
P_T = pressure at wellhead, psia.
S = gas sp. gr. (air = 1.0)
d = well depth, ft.
z = compressibility factor
T = average flow temperature, °R.
Q = flow rate, std. M.c.f. per day
D = i.d. of flow string, in.

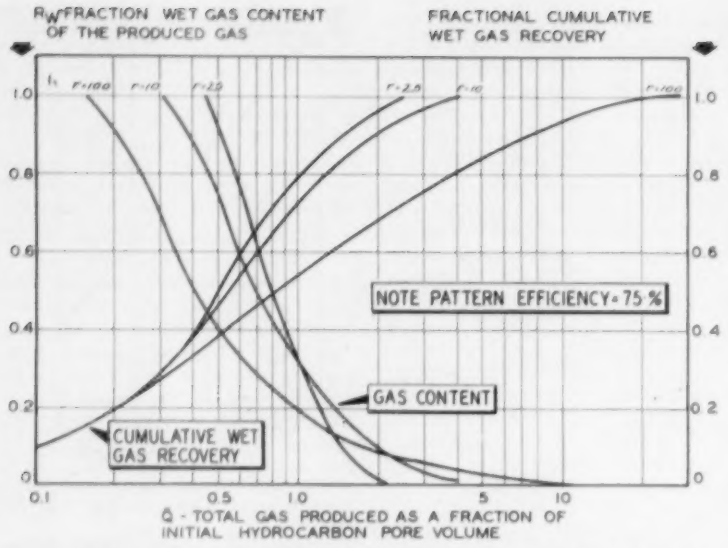
Using flow rates and drawdowns from well RG-14 in the above equation, the potential of an individual well utilizing 4-in. tubing is as shown in Fig. 7.

The reservoir performance was calculated using the well potential and the material balance based on reservoir pressure. This performance of the E sand is presented in Fig. 8 as a time function. Pressure depletion of the reservoir would produce 39 per cent of white oil (10,100,000 bbl.) and 183,000 M.M.c.f. of separator gas in 19.5 years, based on the 1953 reservoir estimates.

For the depletion study of the Colorado G sand, the equilibrium constants curve constructed for the Colorado E sand was used. This curve is applicable because of the similarity of the two reservoir temperatures, pressures, and compositions of the gases. The depletion study of the Colorado G sand as a pressure function was performed using



DEPLETION PERFORMANCE of Colorado E Sand reservoir at Santa Rosa would be as shown. The function with time depends on the producing well potentials. Fig. 8.



WET GAS CONTENT of produced gas and cumulative wet gas recovery depends on the volume of gas injected in cycling operations. Parameters are permeability stratification constant as described by Muskat.[3] Fig. 9.

equilibrium constants and normal material balance. Individual well potentials as a function of the reservoir pressure were calculated like those for the Colorado E sand.

Using the well potential and the material balance based on reservoir pressure, the reservoir performance pressure depletion of the Colorado G sand reservoir would produce 23 per cent of white oil (5,640,000 bbl.) and 91,000 M.M.c.f. of separator gas in 19 years, based on 1953 gas reservoir size estimate. Estimated valume of oil in place has since increased from 33 to 87.5 million barrels.

Dew-Point Cycling

A separation study was also performed to determine the optimum separation facilities for a cycling program using the calculated composition of the reservoir gas.

Abandonment gas-oil ratio of 50,000 cu. ft. per bbl. of stable stock-tank oil is used in all cycling calculations. The pattern efficiency is assumed to be 75 per cent. The value of the pattern efficiency has a maximum effect at high abandonment gas-oil ratios. Thus, to estimate reserves the pattern efficiency is relatively unimportant if good well spacing is adopted.

The physical properties of the gas to be injected are based on having 60 per cent of the suction gas available at 2,400 psi. and 40 per cent of the suction gas available at 1,200 psi. The gas compositions used in the separation study are also used for the cycling calculations.

For the Colorado E sand with an abandonment gas-oil ratio of 50,000 cu. ft. per bbl., the reservoir gas produced will be 50,947 cu. ft. of reservoir gas per barrel of stock-tank oil. The 947 cu. ft. is the gas condensed per barrel of stock-tank oil. The normal gas-oil ratio by optimum separation is 8,531 cu. ft. per bbl. The reservoir withdrawals will be 9,478 cu. ft. of reservoir gas per barrel of stock-tank oil which includes the 947 cu. ft. of gas condensed. The wet gas in the well stream is 18.6 per cent.

Permeability effect . . . Plotted in Fig. 9 is the fractional wet-gas content of the produced gas (R_w) and fractional cumulative wet-gas recovery versus total gas produced (Q) as a fraction of initial pore volume as described by Muskat.[3] This work is shown for "stratification constants" of 2.5, 10, and 100, with a 75 per cent pattern efficiency. The stratification constant is the ratio of the maximum to minimum permeabilities.

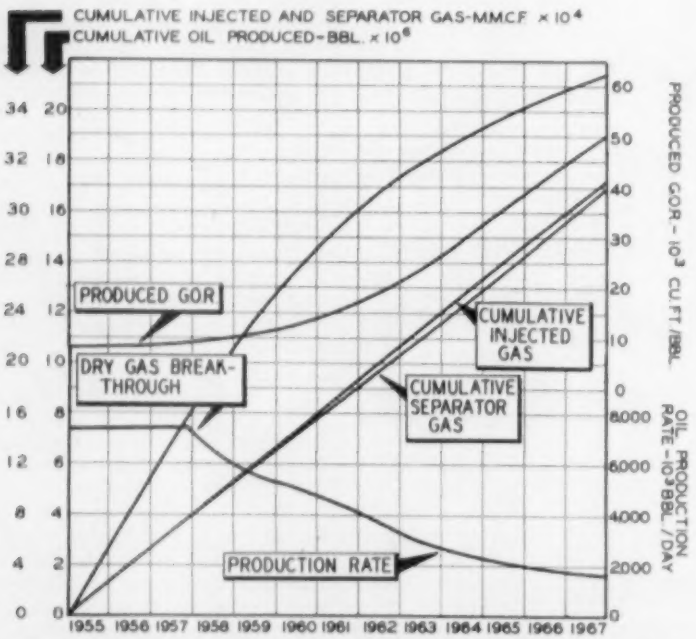
Absolute permeability is relatively unimportant in cycling. The important factor for cycling is the stratification constant.

The exponential permeability was defined by Muskat[3] by the expression:

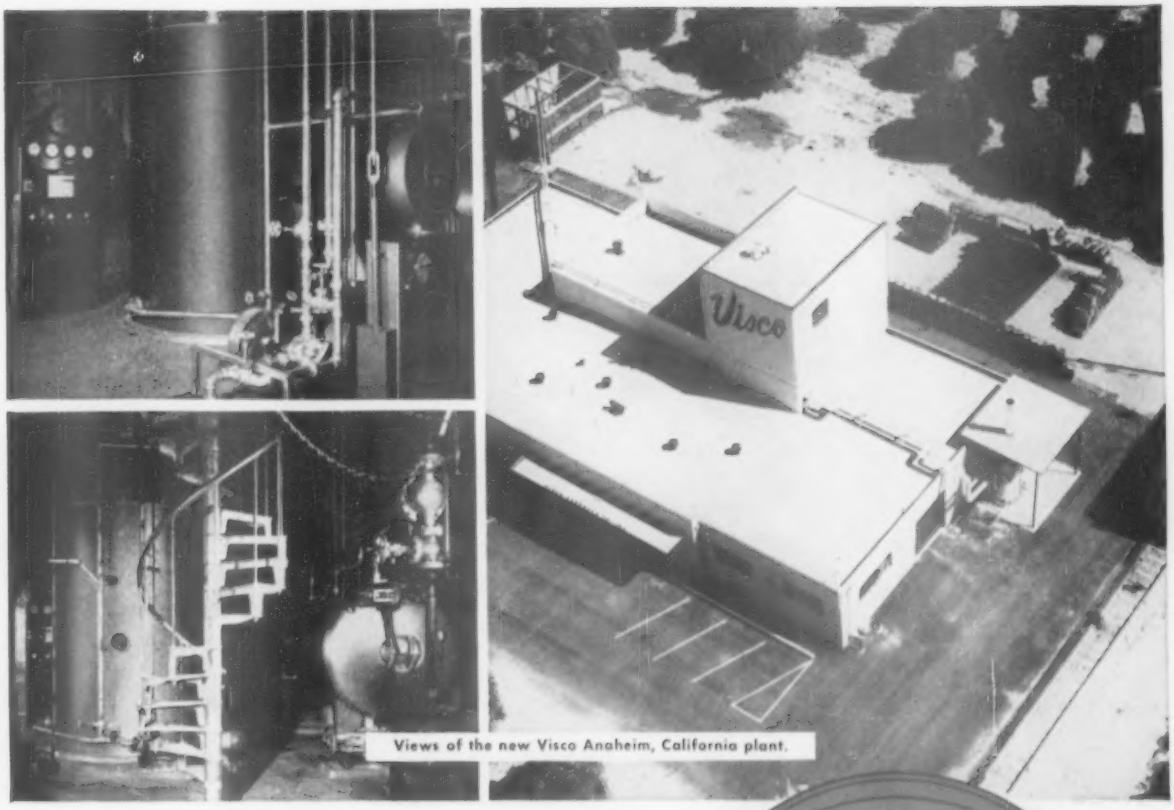
$$K Z = ae^{bZ/H}$$

The information stratum is assumed to be rearranged to give a monotonic permeability with Z, the distance measured along the well bore. H is the thickness of the formation. The constant a is the minimum permeability at Z = 0 and ae^b is when Z = H is the maximum permeability. The stratification constant r is expressed as: $r = e^b = K_{max}/K_{min}$.

Using Fig. 9 and the abandonment gas-oil ratio of 50,000 cu. ft. per bbl. (wet gas in produced stream 18.6 per cent), the estimated ultimate recovery of oil by cycling for the Colorado E reservoir is 84 per cent of the initial wet gas in place. The 1953 estimated recovery by cycling is 233.9 × 10^9


CUMULATIVE INJECTED AND SEPARATOR GAS-MMCF × 10^4
CUMULATIVE OIL PRODUCED-BBL. × 10^6
PRODUCED GOR
DRY GAS BREAK-THROUGH
CUMULATIVE INJECTED GAS
CUMULATIVE SEPARATOR GAS
PRODUCTION RATE
PRODUCED GOR - 10^3 CU.FT./BBL.
OIL PRODUCTION RATE - 10^3 BBL./DAY
1955 1956 1957 1958 1959 1960 1961 1962 1963 1964 1965 1966 1967

CYCLING PERFORMANCE at constant reservoir pressure shows more than twice as much oil recovery as with pressure depletion. Production rate is maintained and recovery is faster. Compare with Fig. 8. Fig. 10.



Views of the new Visco Anaheim, California plant.

Everything's new but the drum of blue and the *Visco* service that goes with it!

Here Visco points with pride to another source of the famous blue drum—a brand new plant at Anaheim, California.

In the field, of course, no one has time to worry about where a product comes from, just so it does a job effectively, economically—*and is always available.*

That's Visco without a doubt, and our new Anaheim plant with all its modern equipment and instrumentation is just a further assurance that Visco quality and service will never let you down.

VISCO PRODUCTS COMPANY
INCORPORATED
Telephone: MAdison 3-0433
2600 Nottingham at Kirby • Houston 5, Texas
PLANTS AT ANAHEIM, CALIFORNIA and SUGAR LAND, TEXAS

Visco® **CONSISTENTLY EFFICIENT OIL INDUSTRY CHEMICALS**

The 1956 Super 18 Beechcraft carries eight persons in luxurious travel comfort. Its superbly appointed, custom-tailored cabin — its big rugged frame — its powerful engines — and its unexcelled performance and utility are the result of the inspired craftsmanship which has produced more than 10,000 twin-engined BEECHCRAFT airplanes — world-renowned for their superiority of design and construction.

Ask about Beechcraft's Leasing and Financing Plans. Contact your Beechcraft Distributor or Dealer or write direct to Beech Aircraft Corporation, Wichita 1, Kansas.

Alabama – Southern Airways Co., Birmingham

California – Norman Larson Co., Van Nuys (Los Angeles); Pacific Aircraft Sales Co., Oakland

Colorado – Combs Aircraft, Inc., Denver

Delaware – Atlantic Aviation Service, Inc., Wilmington

Florida – Lopez-Grace Aviation, Inc., Miami

Georgia – Southern Airways Co., Atlanta

Illinois – Butler Airplane Sales, Chicago

Indiana – Roscoe Turner Aeronautical Corp., Indianapolis

Iowa – Elliott Flying Service, Davenport

Kansas – Aircrafters, Inc., Wichita; Topeka Aircraft Sales & Service, Topeka

Louisiana – Currey Sanders Aircraft Company, Inc., Shreveport; Baton Rouge Aircraft, Inc., Baton Rouge

Massachusetts – Atlantic Aviation Corp., Boston

Michigan – Francis Aviation, Lansing

Minnesota – Gopher Aviation, Inc., Rochester

Montana – Butte Aero Sales & Service, Inc., Butte

Nebraska – Lang Aircraft, Omaha

New Jersey – Atlantic Aviation Corp., Teterboro

New Mexico – Cutter-Carr Flying Service, Inc., Albuquerque

New York – Page Airways, Inc., Rochester; Atlantic Aviation Corp., Teterboro

North Carolina – Piedmont Aviation, Inc., Winston-Salem; Southern Airways Co., Charlotte

Ohio – Ohio Aviation Co., Vandalia; Youngstown Airways, Inc., Youngstown

Oklahoma – Aircraftsmen, Inc., Oklahoma City; Tulsair Distributors, Inc., Tulsa

Oregon – Flightcraft, Inc., Portland

Pennsylvania – Atlantic Aviation Service, Inc., Philadelphia; Beckett Aviation, Pittsburgh

South Carolina – Hawthorne Flying Service, Charleston

Tennessee – Capitol Air Sales, Inc., Nashville; Memphis Aero Corp., Memphis

Texas – Tradewind Airport Corp., Amarillo; J. R. Gray Co., Inc., Dallas; J. D. Reed Co., Inc., Houston; Alamo Aviation, Inc., San Antonio

Utah – Kemp & Kelsey Airservice, Inc., Salt Lake City

Virginia – Piedmont Aviation, Inc., Norfolk

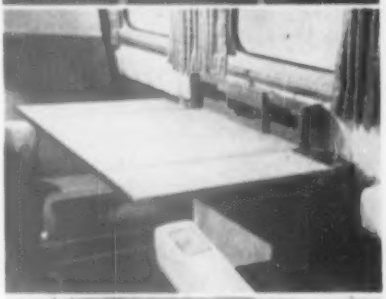
Washington – Flightcraft, Inc., Seattle

Wisconsin – Anderson Air Activities, Milwaukee

Beechcraft distributors are located in 44 foreign countries. For information write the Export Sales Department, Beech Aircraft Corporation, Wichita 1, Kansas

AND BUSINESS, TOO!

Without the trouble of fitting your travel schedules to the plans of others, you can be at the Army-Navy game — or at a distant business location — when you own a BEECHCRAFT SUPER 18. There's more time for business . . . and more time for pleasure, too. The new Super 18 Executive Transport saves up to 75 per cent of your travel time with direct-to-destination cruising speeds of 215 miles per hour. No other twin-engine executive transport built today offers so many *exclusive* features: taller, roomier cabin with "walk-around comfort" — super-soundproofing — high payload capacity with 1½-tons of useful load — big, extra wide cabin windows for added travel enjoyment — built-in stairway and, of course, the pride and prestige that accompanies BEECHCRAFT ownership. That's why Model 18 BEECHCRAFTS outnumber all other twin-engine business airplanes. That's why your BEECHCRAFT distributor or dealer will offer you the *best* buy in business transportation.



Beechcraft

BEECHCRAFTS ARE THE AIR FLEET OF AMERICAN BUSINESS

std. cu. ft. × 0.84 = 196.5 × 10^9 std. cu. ft. of wet gas.

The estimated initial gas compressibility factor for the Colorado E reservoir gas is 0.913, and the reservoir gas formation volume factor is 241.0 std. cu. ft. per reservoir cubic foot. The estimated gas-compressibility factor for the injected gas is 0.965 was a gas formation-volume factor of 228.9 std. cu. ft. per reservoir cubit foot. With this difference in the gas formation-volume factor, only 228.9 std. cu. ft. of dry gas need be injected for a constant pressure operation when 241.0 std. cu. ft. of reservoir gas is produced.

The dry gas necessary to complete the cycling program is 142 per cent of the initial gas volume of the reservoir (reservoir volume) and in standard cubic feet is 134.9 per cent of initial gas in the reservoir. With the 1953 estimate of wet gas in place of 233.9 × 10^9 std. cu. ft. the necessary gas volume to inject would be 315.5 × 10^9 std. cu. ft.

Using two 1,320-hp. compressors approximately 66 M.M.c.f. of gas per day could be injected. The resulting production is 69.5 × 10^6 std. cu. ft. per day.

With 30.4 days per month, the average monthly production at this rate will be 2.1 × 10^9 std. cu. ft. Thus, the time to cycle the 1953 proven and semiproven volume of the Colorado E sand is 158 months, or approximately 13 years.

Production . . . The produced gas from constant-pressure cycling of the Colorado E sand will be 25.2 × 10^9 std. cu. ft. per year, which is equal to 10.77 per cent of the initial reservoir-gas volume. Predicting the producing rates and gas-oil ratios, the fractional production of the initial reservoir-gas volume per year was accumulated. The corresponding values of cumulative wet-gas recovery, as a fraction of the initial wet gas, and the wet gas fraction of the product stream are obtained from Fig. 9.

Cumulative oil recovery as a fraction of the initial oil in place is equal to the cumulative wet-gas recovery as a fraction of the initial gas in place. The producing gas-oil ratio calculated on a M.M.c.f. basis of produced gas is:

$$GOR = \frac{(1 \times 10^6) - (105.8)\,(947)\,(R_w)}{(105.8)\,(947)\,(R_w)}$$

where R_w is the fractional wet gas in the produced stream, 947 cu. ft. per bbl. is the gas condensed in the oil, and 105.8 bbl. is the oil recovery per M.M.c.f. of reservoir gas produced.

Predicted production rates, cumulative oil and gas production, and producing gas-oil ratios are shown in Fig. 10. The assumed 75 per cent sweep efficiency should result from cycling with the existing and future wells to be drilled. The recovery at the end of the cycling program with 2,400 psi. for the first-stage separation, is estimated to be 21,455,000 bbl. of oil out of the 26,050,000 bbl. of oil estimated in place in 1953 (Table 1).

At the completion of the cycling project an additional 1,870,000 bbl. of white oil can be recovered by reservoir blowdown. Recovery of this oil is dependent upon a dry-gas market and producing rates will be controlled by such.

G sand . . . The permeability variation of the Colorado G sand is quite large. Two sand types are present with upper having the lower permeability. Both types have an exponential permeability variation. Stratification constants found in two wells range from 2.25 to 26 for the upper sand type and 77 to 96 for the lower sand type.

The fractional wet-gas content of the produced gas (R_w) and fractional cumulative wet-gas recovery versus total-gas produced (Q) as a fraction of initial pore volume is the same as used for the Colorado E sand shown in Fig. 9.

For the Colorado G sand with an abandonment gas-oil ratio of 50,000 cu. ft. per bbl., the reservoir gas produced will be 50,910 cu. ft. of reservoir gas per barrel of stock-tank oil, of which 910 cu. ft. per bbl. is the gas condensed. The normal gas-oil ratio by optimum separation is 8,767 cu. ft. per bbl. The reservoir withdrawals are 8,767 plus 910 cu. ft. per bbl. or 9,677 cu. ft. of reservoir gas per barrel of stock-tank oil. The wet gas in the well stream is 19.0 per cent.

The estimated initial gas-compressibility factor for the reservoir gas is 0.920; the reservoir-gas formation-volume factor is 235.8 cu. ft. per reservoir cubic foot. The estimated gas compressibility factor for the injected gas is 0.970; the injected gas formation volume factor is 223.6 std. cu. ft. per reservoir cubic foot. From these two formation factors when 235.8 std. cu. ft. of gas is produced, only 223.6 std. cu. ft. of gas will be injected for a constant pressure operation.

Using one 1,320-hp. compressor, approximately 33 M.M.c.f. of gas per day may be injected. This volume of gas represents 0.1476 × 10^6 reservoir cubic feet per day.

The resulting production is 34.8 × 10^6 std. cu. ft. per day for an average monthly production of 1.058 × 10^9 std. cu. ft. With this production rate, the production ratio will be 4.5 M.M.c.f. per day from the tighter sand and 30.3 M.M.c.f. per day from the more permeable sand. Based on these production rates, 1.64 × 10^9 cu. ft. per year will be produced from the tighter sand, and 11.06 × 10^9 cu. ft. per year will be produced from the more permeable sand.

The initial in-place gas in the Colorado G sand is 44.84 × 10^9 cu. ft. for the tight sand and 73.40 × 10^9 cu. ft. for the more permeable sand. With the proposed production rates, the production per year from the tighter sand will be a volume equivalent to 3.66 per cent of the initial in-place gas, and in the more permeable sand will be equivalent to 15.07 per cent of the initial in-place gas.

The oil-production rates for the Colorado G sand were calculated from the gas-production rates and the data in Fig. 9. The predicted reservoir performance curves are similar to Fig. 10, those for the E sand. Recovery at the end of the cycling program is 9,044,000 bbl. of oil based on the 1953 reservoir size. In addition, 1,070,000 bbl. of white oil would be available for recovery by blowdown of the reservoir.

All of these recovery figures are now being revised upward because of recent development drilling and expansion of reserves.

Acknowledgments

The authors wish to acknowledge the help of Mihran Khayan and P. Franco Franci in making many of the lengthy calculations and preparing the exhibits. We also wish to express our application to Mene Grande Oil Co. for permission to publish this paper.

References

1. Standing, "Volumetric and Phase Behavior of Oil Field Hydrocarbon Systems," California Research Corp., 1951.
2. Buthod and Whitely, The Oil and Gas Journal, Dec. 22 and 29, 1945.
3. Muskat, Trans. A.I.M.E., 1949, Vol. 179.
4. Weinaug and Bradley, Trans. A.I.M.E., 1951, Vol. 192.

Are You Among the Drilling Contractors?

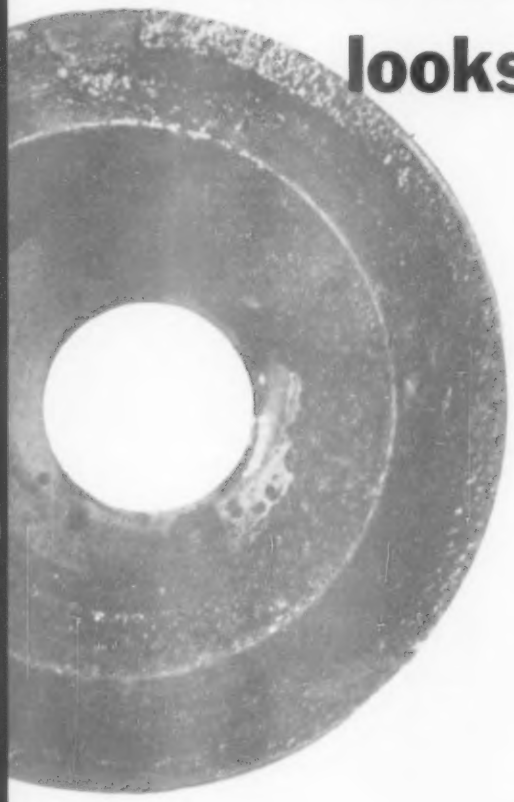
Your Journal editors are . . . so they can keep track of what's going on and pass on the information to you.

Don't overlook "Among the Drilling Contractors' . . . a weekly Journal feature designed to keep you up to date with what other contractors are doing—who is drilling where.

When metal pipe looks like this...

The metal pipe is almost completely clogged with paraffin. The clean Tenite Butyrate pipe has been in service for months on a high-paraffin oil line. (Paraffin accumulated only on the steel pipe connector.)

TENITE BUTYRATE looks like this...



BECAUSE of the extra-smooth walls of pipe made of Tenite Butyrate plastic, the problem of paraffin accumulation when carrying high-paraffin crudes is often completely eliminated.

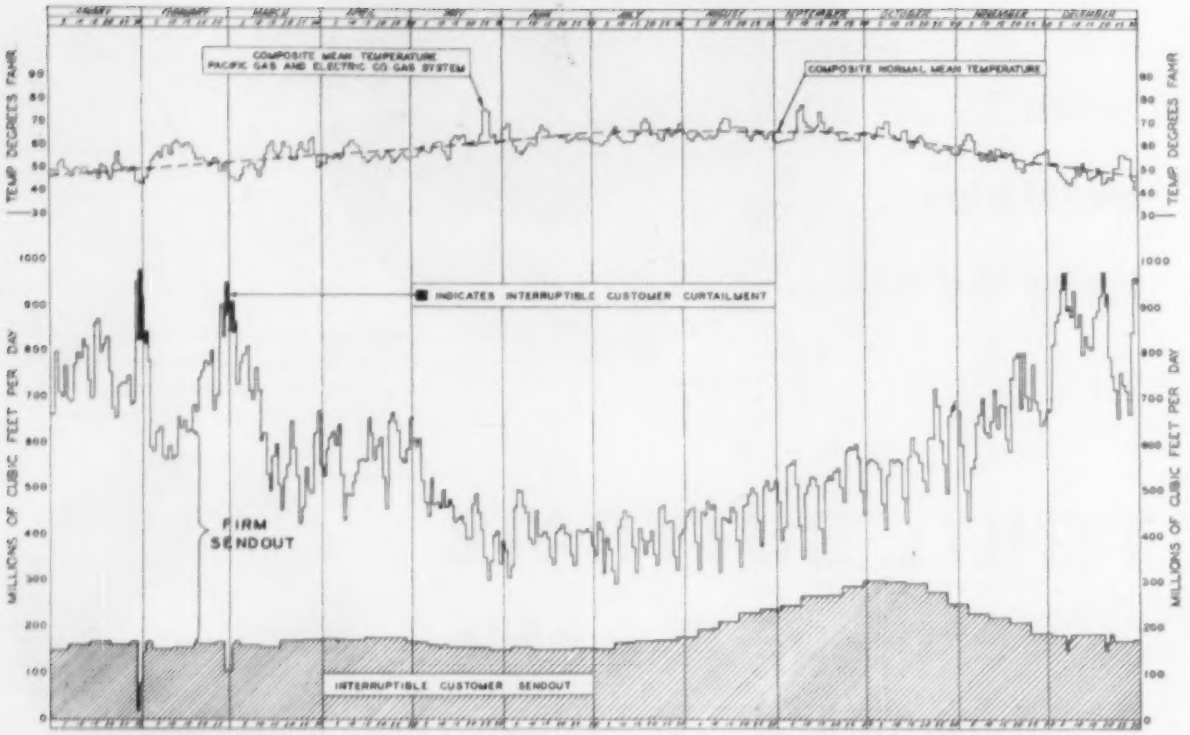
In addition, Tenite Butyrate does not corrode. It is used successfully in low-pressure lines carrying sour crudes and salt water. It is also unaffected by electrolytic action. As a result, under many conditions which cause metal pipe to clog or leak, Tenite Butyrate continues to give trouble-free service.

Tenite Butyrate plastic pipe offers many other advantages. It is joined easily in the field with the use of just a paint brush and solvent cement; it is cut easily with a hand saw; it weighs only one-sixth as much as metal pipe and often provides as much as 40% greater flow volume for any given head loss. You get a pipe line that is easily installed, that performs efficiently, and requires virtually no maintenance.

We will be glad to give you the names of companies that produce pipe and a complete range of fittings made of Tenite Butyrate, as well as additional information about this Eastman plastic. Write EASTMAN CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company, KINGSPORT, TENNESSEE.

A 16-mm. sound-color film, "PLASTIC PIPELINES," is available upon request.

TENITE
BUTYRATE
an Eastman plastic


COMPOSITE MEAN TEMPERATURE
PACIFIC GAS AND ELECTRIC CO GAS SYSTEM
COMPOSITE NORMAL MEAN TEMPERATURE
TEMP DEGREES FAHR
INDICATES INTERRUPTIBLE CUSTOMER CURTAILMENT
FIRM SENDOUT
INTERRUPTIBLE CUSTOMER SENDOUT
MILLIONS OF CUBIC FEET PER DAY

INTERRUPTIBLE AND FIRM gas sendout and demand by all P. G. & E. Co. divisions for year 1951. Fig 1.

Everybody talks about it, but heating-fuel producers have to bet on it

Reducing the Odds in Weather Betting

by Charles Pennypacker Smith

THE production of heating fuels is a function of consumer demand, and this is controlled by the weather. Up to the present time, extended-period weather forecasts, for periods of 3 months to a year ahead, have not shown any significant improvement over climatological averages or normals.

The concept of a typical year should be an aid to long-range planning of natural-gas production.

A statistical method for estimating quarterly and seasonal departures from normal temperature on a "calculated risk" basis may be used. Using data for San Francisco, it is shown that in two out of three cases the departure will be in the same direction as in the preceding quarter. The temperature in the April-to-June quarter furnishes a correct indicator of the direction of the departure in the following fiscal year, in two out of three cases.

Charts are prepared to indicate the best estimate of the amount of the departure and the probable limits of error indicated by the past experience.

Statistical forecasts of this nature are completely objective, and they furnish a modest but worth-while improvement over the use of climatological normals. They are at least equal in quality to other indexes which enter in the decision process, and they have a legitimate place in fuel supply planning.

Betting on weather . . . Whether we like it or not, every time we set up a production schedule, we are placing a bet on the weather during the next quarter. We may do this by a careful statistical evaluation of historical records and trends, or we may simply use an intuitive hunch, but we are still betting on the weather. Since these bets are pretty substantial, it is worth while to see that the tools used are as sharp as possible.

In order for a prediction to be useful, the trend of the future must be related to the experiences of the past and the status of the present. This is true regardless of whether one is concerned with the national market for shoes, the population of Illinois, the energy requirements of New England, or the next quarter's temperature in San Francisco. We must always start from a current position which has a historical relationship with the past.

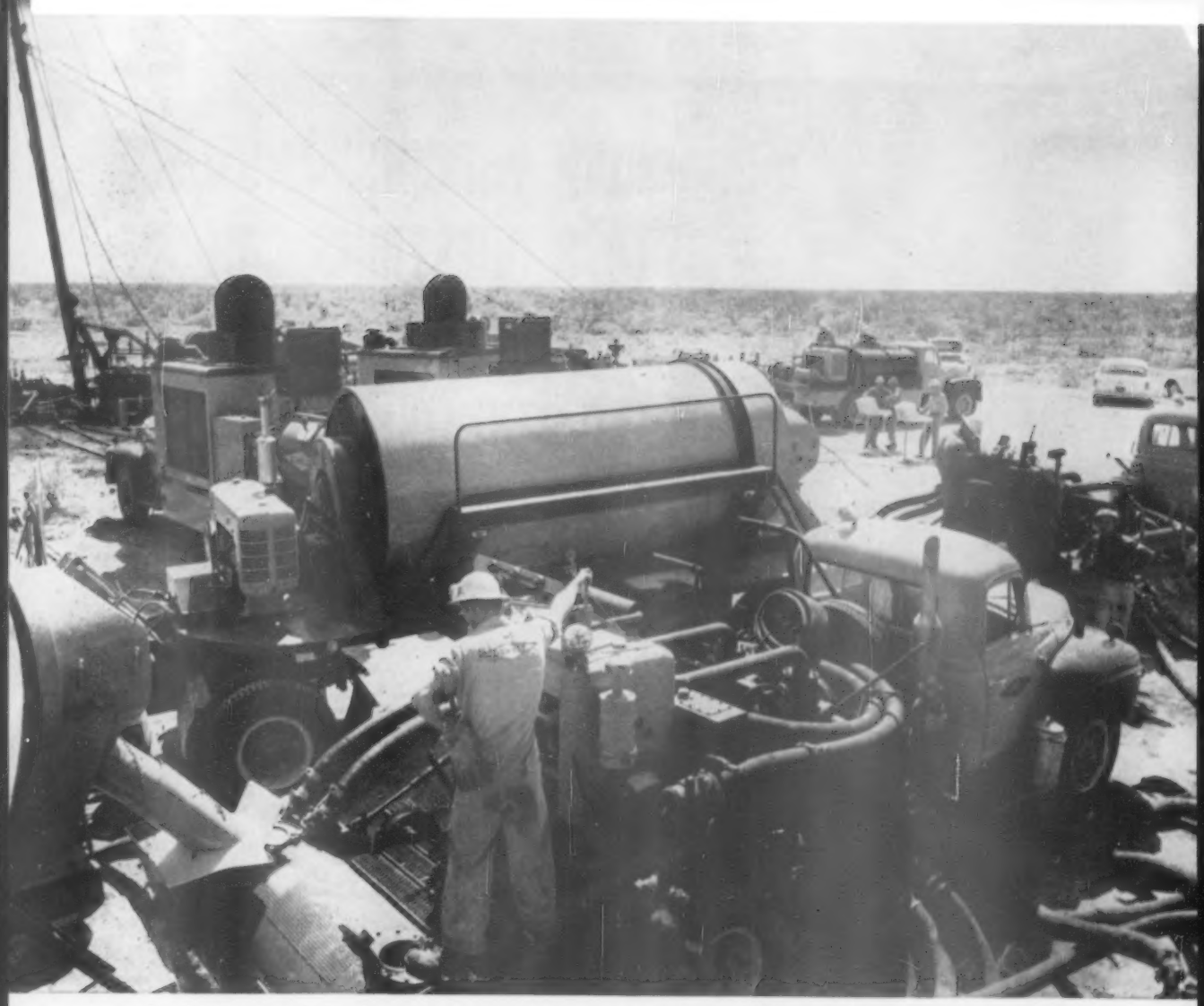
Weather information can be conveniently divided into the three following categories:

1. Information concerning past weather.

2. Information concerning current weather.

3. Information concerning future weather.

Author is with Pacific Gas & Electric Co., San Francisco. Paper presented at A.P.I. annual meeting, Chicago, November 12, 1956, under the original title, "Weather Information Applied to Fuel-Supply Planning."



Dowell engineers control Allison-Powered Pumpers, upper left, from remote panels at upper right. Men in foreground operate blenders.

600 hydraulic h.p. per unit... that's fracturing!

THE DOWELL ALLISON-POWERED PUMPER with its aircraft engine has been performing even beyond expectations. In treatment after treatment, in both oil and gas wells, this rugged Dowell Pumper has proved its dependability.

Also, Dowell has designed a Special Blender to supply the tremendous volume needed by the Pumper. Capable of mixing 60 barrels per minute, the blender can keep the Pumper operating at capacity.

That's not all. The third member of this powerful fracturing team is the revolutionary Dowell-developed Remote Control Panel. This panel allows complete operation of the unit from any distance up to 125 feet. In addition, it offers protection for men and equipment. Automatic controls stop the whole operation when pre-set pressure and volume limits are exceeded.

For more information, or service, call any of the 165 Dowell offices in the United States and Canada; in Venezuela, contact United Oilwell Service. Or write to Dowell Incorporated, Tulsa 1, Oklahoma, Dept. K-11.

services for the oil industry

DOWELL

A SERVICE SUBSIDIARY OF THE DOW CHEMICAL COMPANY

JOHN WIGGINS' ANSWERS TO 8 QUESTIONS CAN HELP YOU SELECT A BETTER FLOATING ROOF SEAL

Are all floating roof seals the same? What about safety? Conservation? We asked John Wiggins, inventor of the floating roof and noted conservation authority, to answer questions most commonly asked about the new Wiggins Safety Seal.

1—**Q.** In the new Wiggins Safety Seal does any of the mechanism contact the liquid?

A. No. All metal working parts are out of the liquid away from corrosive vapors.

2—**Q.** Does the new "Weather Hood" provide longer fabric life?

A. Yes—the fabric is protected from the sun and other elements—lower temperature under the hood provides added conservation.

3—**Q.** In old style seals, rust and scale accumulate and shorten seal life. Does this happen with this seal?

A. The "Weather Hood" prevents rust and scale from depositing in the "seal loop"—thereby increasing seal life.

4—**Q.** Does the Wiggins Safety Seal prevent rim fires?

A. Yes—design of the seal virtually eliminates critical vapor spaces where air and vapor collect to form explosive mixtures. When exploded through controlled tests, the fabric was able to expand enough to contain the explosion without tearing.

5—**Q.** Is this seal safe for the storage of low vapor-pressure, low flash-point liquids such as jet fuels?

A. Yes, the design of the Wiggins Safety Seal reduces the danger area to a minimum so that it can be used in the storage of jet fuels with complete confidence.

6—**Q.** How does the Wiggins Safety Seal guarantee maximum protection against evaporation loss?

A. Air-vapor volume of the Safety Seal is less than 10% of the present volume for floating roof seals. This would eliminate most losses. In addition, the air-vapor space is shielded by a "Weather Hood". This area—the area that breathes—reduces losses to a minimum.

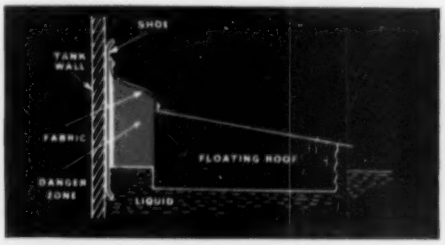
7—**Q.** Will the Wiggins Safety Seal save me money?

A. Yes—by eliminating losses due to thermal breathing, preventing rim fires, use of new longer-lived fabric, protecting the mechanism from liquid and corrosive vapors and permitting much longer periods of "in-service" operation.

8—**Q.** Why have you put so much emphasis on the seal?

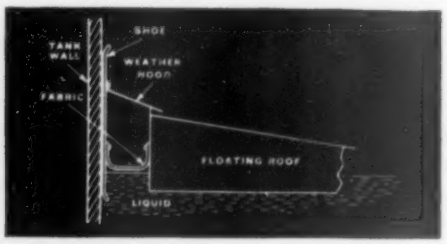
A. A floating roof is only as safe as its seal. With the new Wiggins Safety Seal, Wiggins floating roofs are in a class by themselves. Since General American makes all types of floating roofs, you can have the Wiggins Safety Seal on the roof that best meets your needs—whether it be the Wiggins Hidek*-Lodek* or Doubledek*.

*Patented



OLD

With the old type seal, the fabric is exposed to the sun's rays and explosive vapor collects in the large space between the liquid and the fabric; the mechanism is submerged in the liquid and exposed to corrosive vapors.



NEW

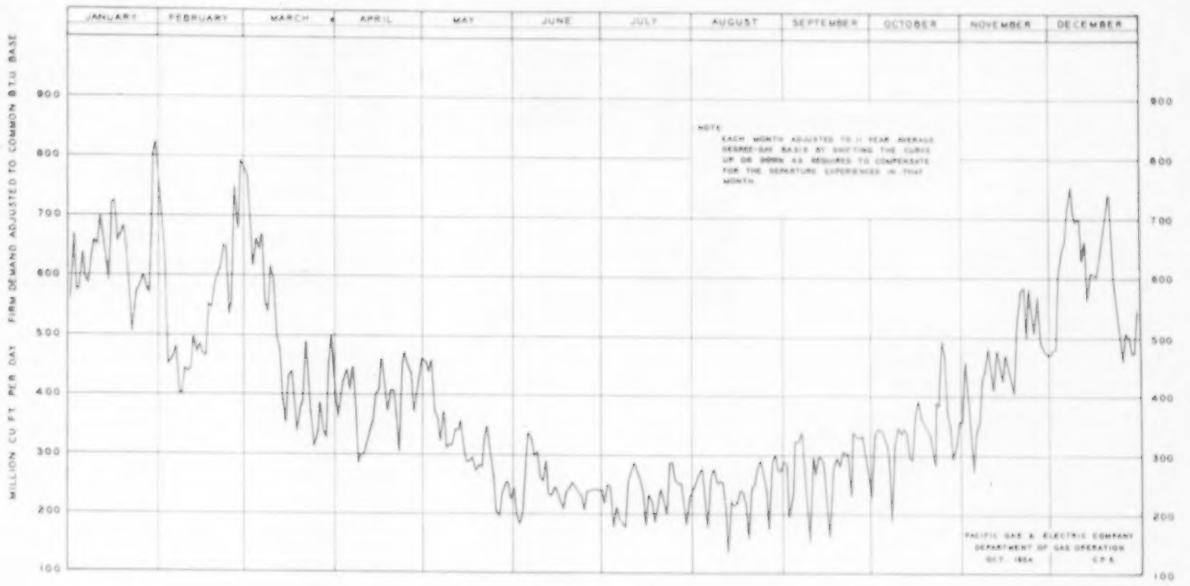
With the new Wiggins Safety Seal, vapor space under the circumferential fabric is reduced to a minimum. Ends spark fire hazards. Fabric is protected from the sun. Mechanism is out of liquid and corrosive vapor space.

To see why Wiggins Floating Roofs pay for themselves, write or call your General American sales engineer.

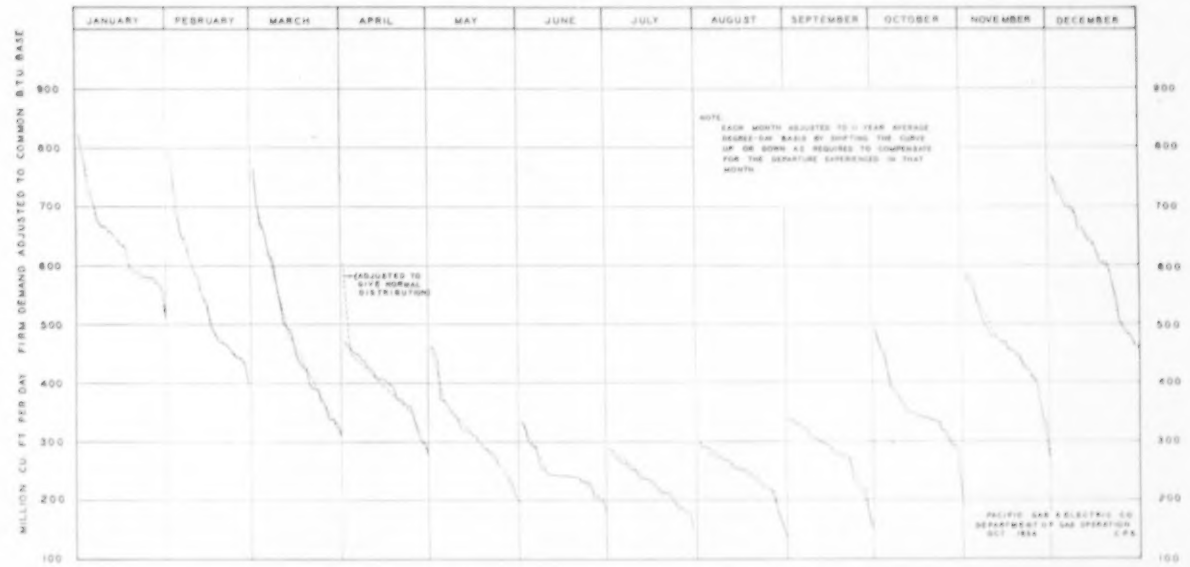
PLATE AND WELDING DIVISION

GENERAL AMERICAN TRANSPORTATION CORPORATION

135 South La Salle Street, Chicago 90, Illinois



FIRM CUSTOMER SENDOUT for P. G. & E. Co. in 1951. Fig. 2.



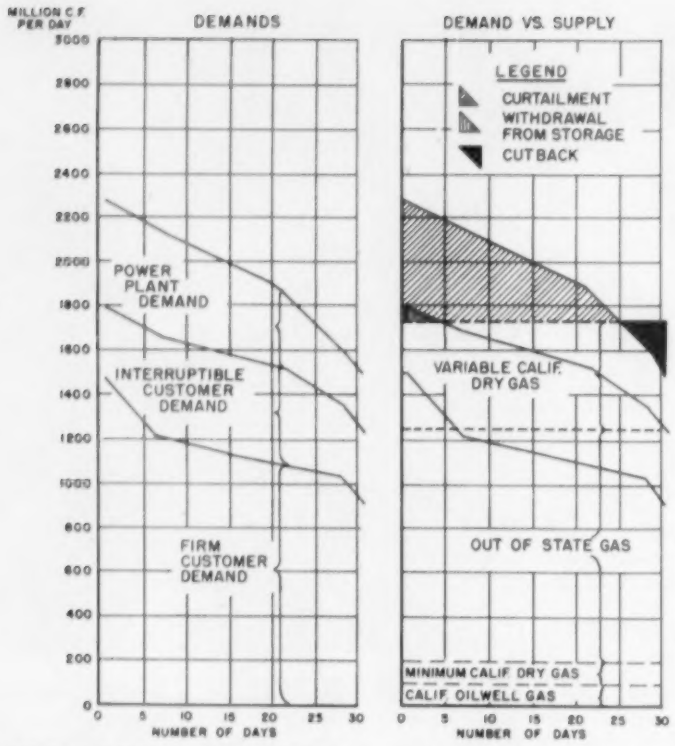
FIRM CUSTOMER SENDOUT for P. G & E. Co. in 1951, arranged in descending order. Fig. 3.

Past weather . . . This information is contained in a great body of statistics known as climatological records, maintained by the United States Weather Bureau. At nearly 6,000 locations throughout the nation the maximum and minimum air temperatures are measured each day under reasonable standardized conditions. The measurements are tabulated and published in the Weather Bureau's monthly climatological summaries, which are distributed to subscribers approximately 5 weeks after the end of each month. They contain monthly degree-day statistics for each station at which the temperature is measured.

For those who require greater detail, or who need data without this 5-week delay, individual station summaries are published once a month for certain major locations; they are available shortly after the end of the month.

Individual station records vary in length from a few years to more than 100 years, with an average of approximately 10 years. Arithmetic averages of temperature and rainfall during the 1921-to-1950 period are currently used as "normals," and the departures from these standardized normals are shown in the summaries. Normals are revised at 5-year intervals. Many of the data are available on punch cards which can be processed mechanically.

Current weather . . . This information is available in the form of periodic bulletins in summary form, or in great detail in the form of raw-data (field-measurement) reports. For many commercial and agricultural needs the summaries issued every 6 hours by the Weather Bureau, through the press and radio, suffice. Some industries, most



FUTURE DEMAND AND SUPPLY forecasts for northern California companies, for January 1961. Fig. 4.

notably aviation, require much more detailed and frequent measurements.

Every 6 hours observers on duty at several hundred stations throughout North America and on ships at sea take a detailed census of the weather. Their observations are transmitted in simple coded form over weather teletype circuits operated by the Civil Aeronautics Administration, and they are the basic working tool used in weather forecasting, both governmental and private.

Access to these teletype circuits is available at nominal cost to any taxpayer having a legitimate need. Several natural-gas-transmission and distribution companies, and nearly all private weather-consulting organizations, receive the basic current-weather observations in this manner—for processing and use by professional meteorologists on their own staffs.

Future weather . . . This information involves the forecasts which are familiar to most people; it also involves some of the great unknowns in meteorology.

In order to predict the weather at a specific time in the future, the professional meteorologist must consider the past movements of the air masses, fronts, and storm systems in time and space; the energy changes which have occurred and will occur as the systems move; the effects of geography; and other factors which cannot be adequately measured at the present time.

From all of this he must deduce the movements and changes during the forecast period, and must translate these into recognizable weather patterns to be seen at the fixed location for which the forecast is made.

The air masses and fronts are continually in motion. Generally they transit the entire nation in 3 to 5 days. The air mass over Seattle today will probably be in the Middle West by Wednesday, and off the East Coast in another 2 days.

The movement of an individual storm in the great atmospheric currents may be compared to an individual eddy in a river. When the eddy is in sight, an observer can tell fairly well where is is going and what it will do; if he cannot see it, because it has not yet come around a bend in the river, he cannot predict its motion or even its existence. The best he can do is to predict the average course of a number of eddies over a period of time.

Short-range weather forecasts are far from perfect, yet they do present a fairly accurate picture of the weather changes during the period in which the storm center is in sight. Beyond the 3 to 5-day period their accuracy deteriorates rapidly and is usually no better than that of statistical averages.

Following are some practical suggestions on how the vast body climatological records can be used to improve our estimates of fuel demands for heating.

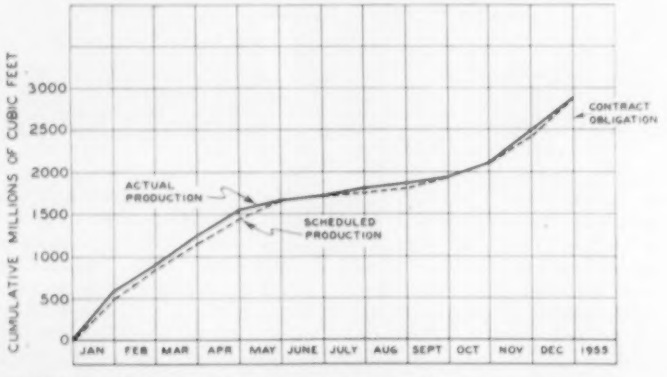
Long-Range "Normal" Forecasts

The problems involved in estimating customer demands for natural gas, and in scheduling and monitoring production to meet these demands, have much in common with those of the petroleum industry. Both industries serve large blocks of heating load controlled by weather.

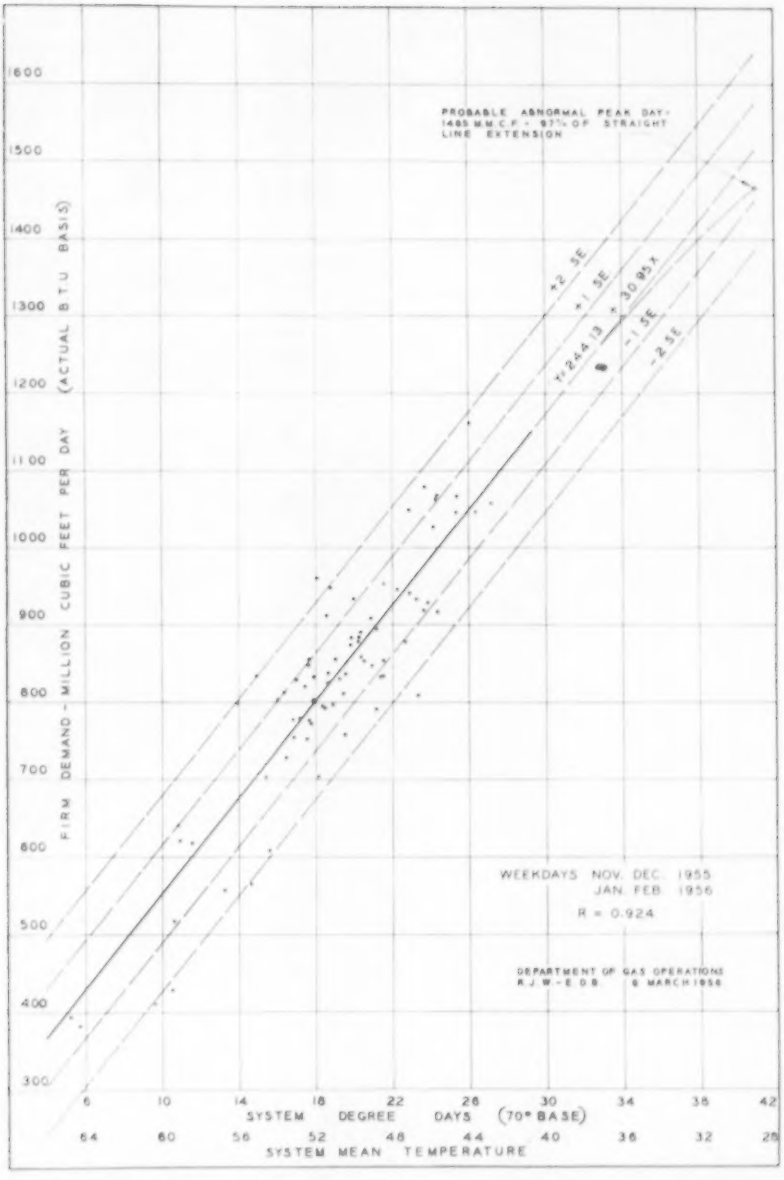
Each has complex problems of scheduling production to conform with field and leasehold allocations, contract obligations, maximum efficient well rates, plant and pipeline-capacity limitations, and storage capabilities.

Inasmuch as my activities are centered in the natural-gas industry, I must draw mainly on this experience in order to discuss practical problems. The reader will recognize parallel applications to his own business.

Long-range customer-demand forecasts are generally set up on the assumption that normal temperatures will prevail. What is this so-called "normal" temperature? It is merely the arithmetic average of past records over a period of years. The normal-temperature curve for a long-record station will plot as a



OPTIMUM PRODUCTION SCHEDULE developed for one particular dry-gas field in California. Fig. 5.



FIRM SENDOUTS on weekdays for P. G. & E. Co. during the past winter, as function of degree-days. Fig. 6.

smooth sinusoidal wave, from winter to summer and back to winter again, with only a slight change from day to day.

Weather does not happen that way! A typical year consists of cold and warm periods alternating around the annual cycle. From one day to the next, one week to the next, and one month to the next, there are considerable changes in the atmospheric temperature, caused by the passage of dissimilar air masses over a given area.

Weather pattern . . . Fig. 1 shows this pattern. The upper part of the figure shows the day-by-day fluctuations of the daily mean temperature above and below the normal curve during 1951.

The lower part of the chart shows the day-by-day natural-gas sendout to customers: the bottom shaded area represents deliveries to large industries served on an interruptible basis, comparatively unaffected by weather except when curtailment is necessary; the portion labeled "firm sendout" represents gas consumed by the thousands of homes, commercial establishments, and small industries which are served on a priority basis.

More than 90 per cent of these customers use gas for space heating. This segment of the demand is particularly sensitive to weather. It should be noted that there is close inverse relationship between the upper and middle curves. The regular cyclic decreases every few days are caused by week ends and holidays, when small businesses and schools are closed.

The year 1951 was used for this study because it is the one year of recent record in which monthly and annual temperatures and rainfall were very close to the normal values. It is considered a typical "normal" year for forecasting purposes.

Firm demand . . . Fig. 2 shows the firm demand only, plotted day by day as it actually occurred. Adjustments were made to correct for the monthly departures from normal temperature by increasing or decreasing each day of the month an equal amount, thus preserving the actual pattern of day-by-day changes.

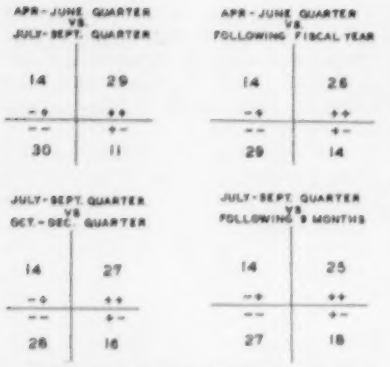
In Fig. 3 the data from Fig. 2 are arranged in descending order within each month, from the highest to the lowest values. We can see from this figure that even in a normal month there are wide swings in the daily firm gas consumption, in the order of two to one.

For convenience in applying these frequency distributions to other years for forecasting purposes, dashed straight lines were drawn in to approximate the shape of the curves, with only a few inflection points in any one month.

In order to apply these accumulative frequency distributions to future years, the analyst would start with a forecast of the number of customers, and the historical trend in usage per customer for the particular month of the year. These steps are omitted here because they are conventional procedures in most businesses. The monthly demand would then be apportioned to fit the frequency distribution of Fig. 3.

Future forecast . . . Fig. 4 shows such a forecast, for January 1961, for northern California companies. In this figure, in addition to the load forecasts, estimates of the supply available are shown. This permits the determination of the number of days and the extent of reductions below maximum capability of various sources of supply, the amount of curtailment of interruptible customers, injection and withdrawal from underground storage, and the development of optimum production schedules.

In practice, frequency distributions similar to those in Figs. 3 and 4 are also set up on the basis of the coldest and warmest winters of record. This permits the system capabilities to be tested under the most adverse conditions, and gives a reliable measure of the limits within



DIRECTION OF DEPARTURES from normal temperatures, San Francisco. Fig. 7.

which operations must be conducted.

Optimum production . . . Fig. 5 is an actual example of the optimum production schedule developed for one particular dry-gas field in California. The production scheduled for the year is shown on the broken line; the actual production is shown by the solid line. Throughout the year, by periodically comparing the accumulated production to the desired schedule, adjustments were made which resulted in the total for the year coming very close to the desired quantity. Similar schedules are set up and monitored for each source of supply, of which there are now 52.

Fig. 6 will be of interest to those who are responsible for forecasting. The actual firm sendouts on weekdays during the past winter were plotted against the weighted system temperature or degree-days. The linear regression, computed by the least-squares method, is the solid slanting line at the center.

The parallel broken lines represent one and two standard errors of estimate above and below the regression. The important inference to be drawn from this figure is that even if you knew exactly what the mean temperature would be, for a particular day, you could not determine the heating demand within limits of approximately ±15 per cent.

This is because the temperature is not the only factor which affects heating demand; wind and rainfall also are involved. Other periods of a month or a quarter, for which the petroleum industry requires forecasts, these other factors tend to average out. However, this illustration may explain why some of your customers occasionally run out of oil unexpectedly.

The "Calculated Risk" Method

Although scientific understanding of the phenomenon of persistence in weather is admittedly weak, there is some evidence which indicates that changes in the broadscale atmosphere circulation patterns tend to be self-sustaining and, therefore, effective over long periods of time.

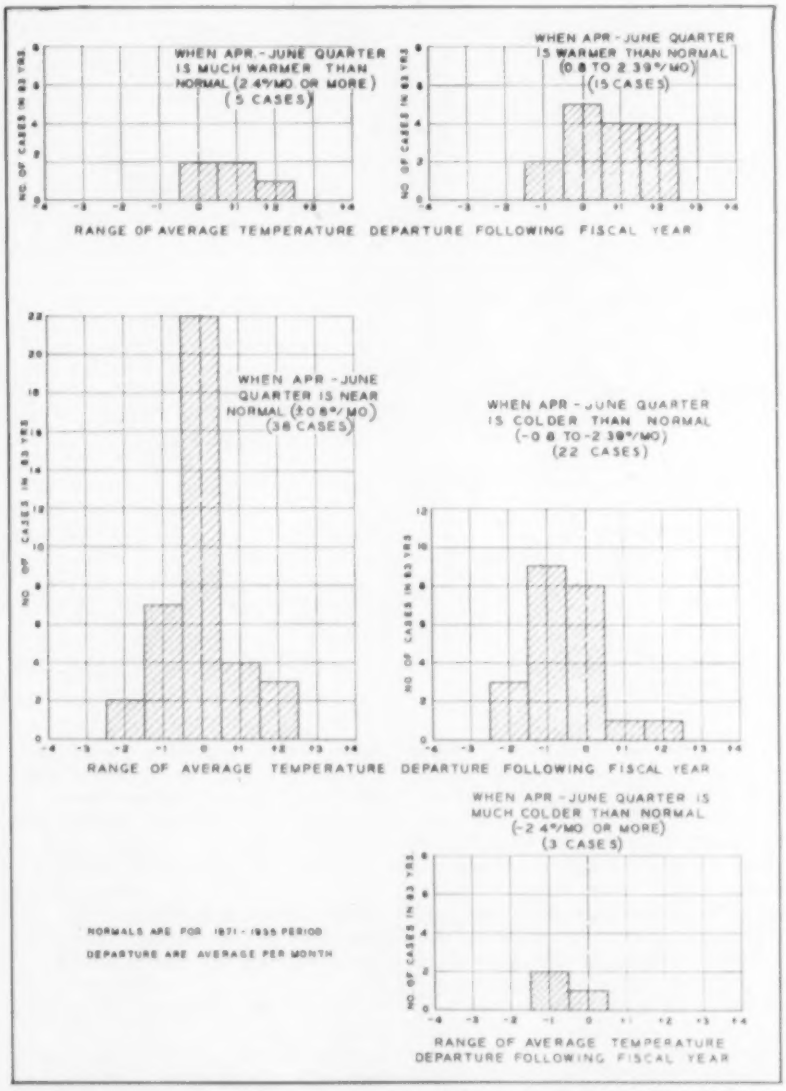
Temperature records have been maintained in San Francisco by the United States Weather Bureau and its predecessor, the Army Signal Corps, since 1871. We have computed normal temperatures for each calendar quarter of the year for the full 84 years of record. Examination of the quarterly departures from normal discloses some interesting facts, as indicated in the table.

There are, therefore, nearly two chances out of three that the departure in any given quarter will be in the same direction as in the preceding quarter.

Weather conditions in California during the spring and summer months are predominantly controlled by the broadscale circulation patterns. Moving cyclonic storms or short-period troughs have comparatively minor effects. This suggests that the departure during the spring quarter might furnish a useful indication of the trend during the following heating season. Fig. 7 shows this to be a fact.

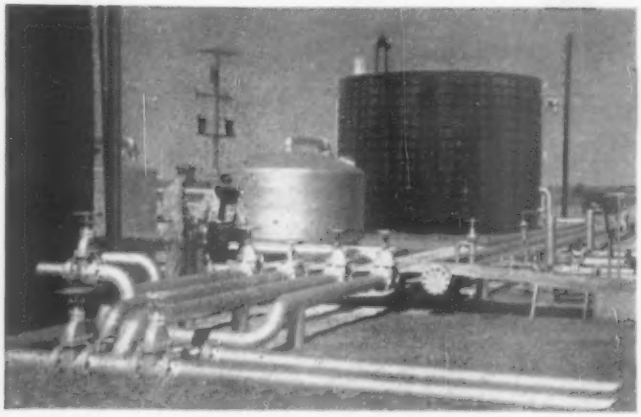
	San Francisco	
Quarter—	Direction of departure (Reversed)	(Persisted)
Spring to summer	25	58
Summer to fall	30	54
Fall to winter	32	52
Winter to spring	35	49
Total	122	213

Contingency table . . . Fig. 7 is a con-


WHEN APR.-JUNE QUARTER IS MUCH WARMER THAN NORMAL (2.4°/MO. OR MORE) (5 CASES)
WHEN APR-JUNE QUARTER IS WARMER THAN NORMAL (0.8 TO 2.39°/MO) (15 CASES)
NO. OF CASES IN 83 YRS
RANGE OF AVERAGE TEMPERATURE DEPARTURE FOLLOWING FISCAL YEAR
WHEN APR-JUNE QUARTER IS NEAR NORMAL (±0.8°/MO) (38 CASES)
WHEN APR-JUNE QUARTER IS COLDER THAN NORMAL (-0.8 TO -2.39°/MO) (22 CASES)
WHEN APR-JUNE QUARTER IS MUCH COLDER THAN NORMAL (-2.4°/MO OR MORE) (3 CASES)
NORMALS ARE FOR 1871-1955 PERIOD
DEPARTURE ARE AVERAGE PER MONTH

TEMPERATURE DEPARTURES from normal during spring quarter in San Francisco, compared with departure in following fiscal year. Fig. 8.

Pumping Unit or Whole Production System



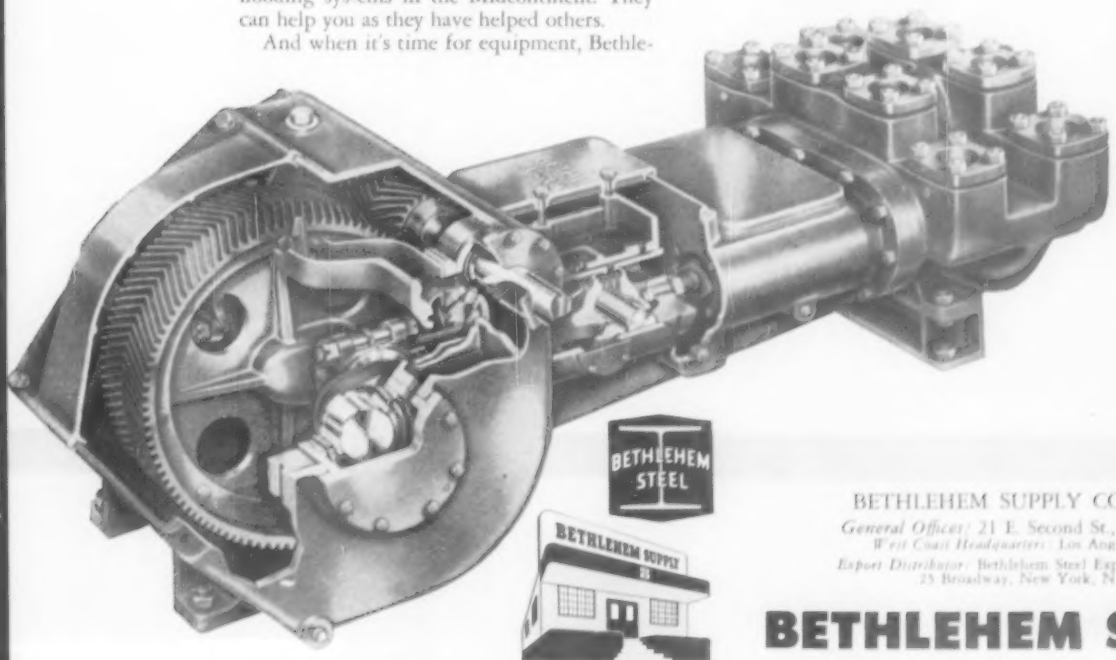
The proper selection of production equipment can be simple or complex – depending upon the way it's handled. Done the Bethlehem way, it's simple, for Bethlehem can furnish every item for a production system.

Take, for example, a waterflood layout. First of all, many details of the planning can be handled advantageously by Bethlehem engineers. These are experienced men; they pioneered the development of turnkey waterflooding systems in the Midcontinent. They can help you as they have helped others.

And when it's time for equipment, Bethlehem supplies not only the pumping units, rods, and bottom-hole pumps, but treating and injection facilities, pipe lines, valves, surface pumps, compressors, prime movers, generators, controls, substations, storage tanks, and buildings.

Each system is tailored individually to meet existing conditions. Each is laid out with provision for growth and future needs, and for maximum operating economies.

We can render the same type of service for turnkey electrification systems. Or, if your needs are minor, we'll be glad to furnish as few as two or three pumping units. The point to remember is, we have what you want in production equipment for all kinds of layouts, regardless of size. Whether you're planning something small or a system as big as all outdoors, we suggest you call us.



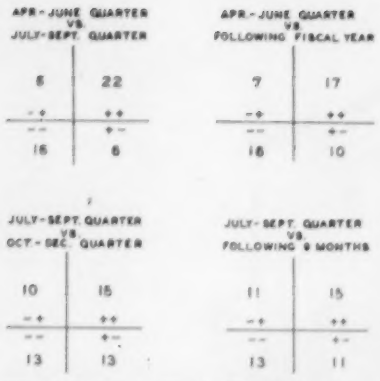
BETHLEHEM STEEL

BETHLEHEM SUPPLY

BETHLEHEM SUPPLY COMPANY

General Offices: 21 E. Second St., Tulsa, Okla.
West Coast Headquarters: Los Angeles, Calif.
Export Distributor: Bethlehem Steel Export Corporation
25 Broadway, New York, N. Y.

BETHLEHEM SUPPLY



DIRECTION OF DEPARTURES from normal temperatures, Chicago. Fig. 9.

tingency table for San Francisco, which shows the number of cases in the full period of record in which the direction of the departure from normal has been maintained or has reversed. The upper left-hand cross shows the relationship between the spring and summer quarters. The number 29 indicates that in 29 years a positive departure in the spring quarter was maintained in the summer quarter.

The number 11 indicates that in 11 years a positive departure in the spring quarter was followed by a negative departure during the summer. Likewise, when the spring-quarter departure was negative, the summer was negative in 30 cases and reversed to positive in only 14 cases.

The upper right-hand cross is nearly as significant. A plus departure in the spring quarter was followed by a plus departure in the following fiscal year in 26 cases, while only 14 cases reversed. A negative spring-quarter departure was followed by a negative year in 29 cases, while only 14 reversed in direction. Here we have a useful tool, since the direction of the season temperature departure can be predicted with 55 chances out of 83 of being correct.

The lower left-hand cross shows the relationship between the summer and fall quarters, and between the summer quarter and the following 9 months. These periods were selected as being of the greatest practical interest in estimating heating demands.

Departure correlation . . . For San Francisco the coefficient of correlation between the departure in the spring quarter and the departure in the following fiscal year is 0.45. This is statistically significant, but it is too low to expect to find a precise mathematical relationship between the magnitudes. The departures were therefore divided into five groups, representing the categories much above, above, normal, below, and much below. The frequencies of these categories are shown in Fig. 8.

In the upper-hand block of Fig. 8 the frequency of occurrence of various seasonal departures is shown when the spring quarter was much warmer (2.4° F. per month or more) than normal. The dashed line shows zero departure, or normal position. Observe that the weighting of the frequencies was also above normal. The mean departure for the following year was +0.75 per month.

The upper right-hand block shows the same relationship when the spring quarter was between 0.8° F. and 2.39° F. per month warmer than normal. The mean departure for the following year was +0.5° F. per month.

The middle left-hand block shows the relationship when the spring quarter was within a band ±0.8°F. per month from normal. In these cases the mean departure was zero.

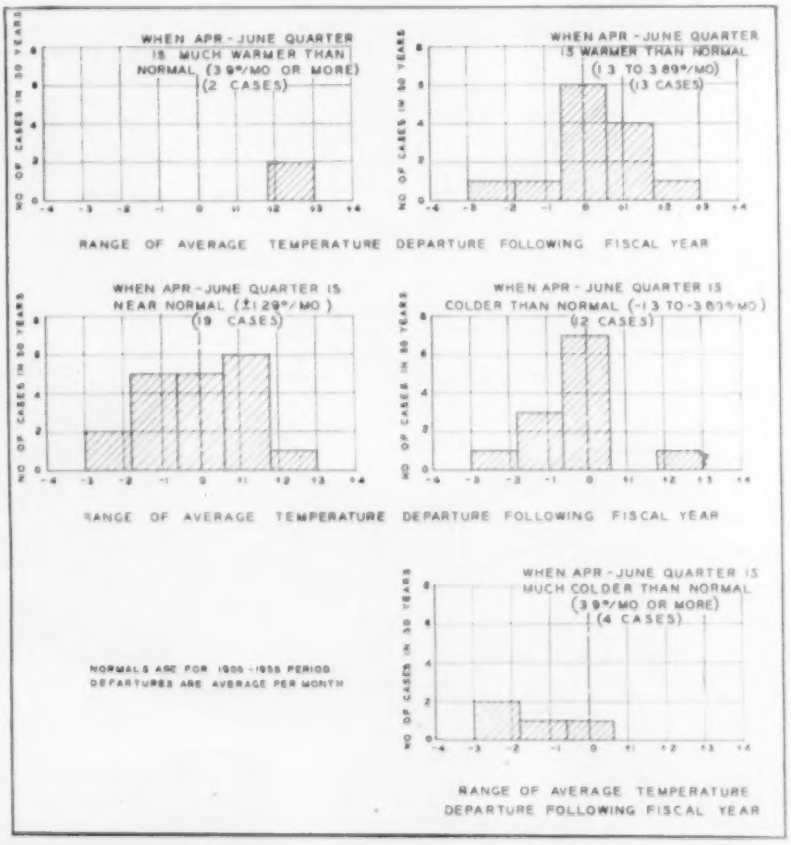
The middle right-hand block is for spring quarters between 0.8° and 2.39° F. per month colder than normal. The mean departure for the following year was 0.5° F. per month below normal.

The lower right-hand block is for spring quarters much colder than normal. The mean departure for the following year was 0.75° F. per month below normal.

Fig. 8 may be used as a model for an objective method of predicting seasonal departures from normal in San Francisco. Ideally, in order to test such a system adequately, the data should be divided into two halves; the method should be developed in one half and tested in the other. However, the length of record does not permit this detailed analysis, so the method was applied against the over-all 84-year record, with the following results:

Total departure of statistical forecast from actual, °F.	722
Total departure from actual if "normal" is forecast, °F.	806
Improvement over "normal" forecast, per cent	10.5
Amount of time statistical forecast is closer, per cent	66
Amount of time "normal" forecast is closer, per cent.	34

It is of interest to note that if the method is applied only to those years in which the spring-quarter departure exceeds 1.0° F. per month—there were 29 such cases—the statistical forecast


WHEN APR - JUNE QUARTER IS MUCH WARMER THAN NORMAL (3.9°/MO OR MORE) (2 CASES)
WHEN APR - JUNE QUARTER IS WARMER THAN NORMAL (1.3 TO 3.89°/MO) (13 CASES)
NO. OF CASES IN 30 YEARS
RANGE OF AVERAGE TEMPERATURE DEPARTURE FOLLOWING FISCAL YEAR
WHEN APR - JUNE QUARTER IS NEAR NORMAL (±1.29°/MO.) (19 CASES)
WHEN APR - JUNE QUARTER IS COLDER THAN NORMAL (-1.3 TO -3.89°/MO.) (12 CASES)
RANGE OF AVERAGE TEMPERATURE DEPARTURE FOLLOWING FISCAL YEAR
NORMALS ARE FOR 1905 - 1955 PERIOD
DEPARTURES ARE AVERAGE PER MONTH
WHEN APR - JUNE QUARTER IS MUCH COLDER THAN NORMAL (3.9°/MO OR MORE) (4 CASES)
RANGE OF AVERAGE TEMPERATURE DEPARTURE FOLLOWING FISCAL YEAR

TEMPERATURE DEPARTURES from normal during spring quarter, compared with departures in the following fiscal year, Chicago. Fig. 10.

yields closer results than the normal 72 per cent of the time.

Chicago data . . . Similar data were prepared for Chicago. In this case the records available to us for analysis began in 1905. Examination of the quarterly departures from normal disclosed the information given in the following table:

	Chicago	
	Direction of departure	
Quarter —	(Reversed)	(Persisted)
Spring to summer	12	39
Summer to fall	24	27
Fall to winter	28	22
Winter to spring	15	35
Total	79	123

For Chicago, the probability of persistence in direction of the departure from spring to summer quarters is nearly three out of four and from winter to spring is two out of three. From summer to fall the odds favor persistence slightly, but for fall to winter the odds favor reversal.

Fig. 9 is a contingency table for Chicago. The persistence between the spring and summer quarters is even greater than was found for San Francisco. Here again there is good correspondence between the direction of departure in the spring quarter and in the following fiscal year.

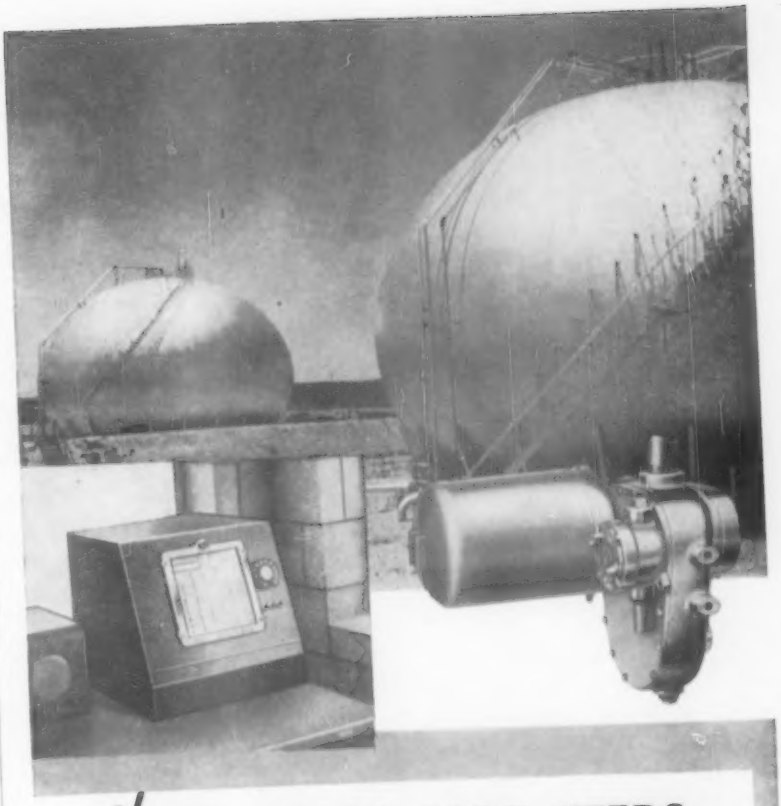
The persistencies from summer to fall and from summer to the ensuing 9 months, are smaller, probably because of the greater frequency of cyclonic storms and short-period troughs affecting the Midwest. The coefficient of correlation between the spring departure and that of the following fiscal year is 0.30, a figure which is statistically significant.

Fig. 10 contains a grouping of the Chicago departures into the same five categories shown for San Francisco (see Fig. 8), and it can be applied in the same manner.

In addition to providing the analyst with an indication of the direction of the season's temperature departure, and a best estimate of the amount, Figs. 8 and 10 also furnish an indication of the ranges of past departures. Using the lower right-hand block of Fig. 10, for example, would give a probable departure of —1.8° F. per month, with range limits of —3.0° F. and +0.6° F.

Acknowledgment

I should like to acknowledge the generous assistance given by F. J. Parsons and G. W. Lunn, staff meteorologists, and R. J. Walker, gas-supply analyst, all of Pacific Gas & Electric Co., in preparing material used in this paper.



"Varec" PULSE CODE KEEPS "TAB" ON OKAN PIPELINE

Keeping a pipeline flowing smoothly is a mighty big job . . . that's why OKAN PIPELINE wants the latest in automatic equipment to speed its work. An important part of this equipment is the "Varec" PULSE CODE Telemetering System, which signals the liquid level of storage tanks at terminals and along the line. In addition to this function, it turns valves on and off by remote control. "Varec" PULSE CODE operates over long distances, giving an accurate signal. It requires only a simple metallic pair for a communication link. It supplies a fast reading in the record time of 5 seconds. There is also a unique feature for remote control of valves, pumps, etc., which confirms that the proper selection of remote function has been made and indicates the status of the selected function. The operator may now change the status and receive a confirmation that it has been completed.

You may want to cut your operating costs by using a "Varec" PULSE CODE System. Equipment for reporting either spot or average temperature, in addition to liquid level, is now available.

Write for "Varec" Bulletin CP-3011 for full details on "Varec" PULSE CODE Telemetering.

961-17

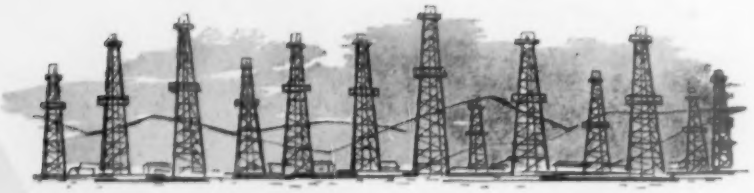
THE VAPOR RECOVERY SYSTEMS COMPANY

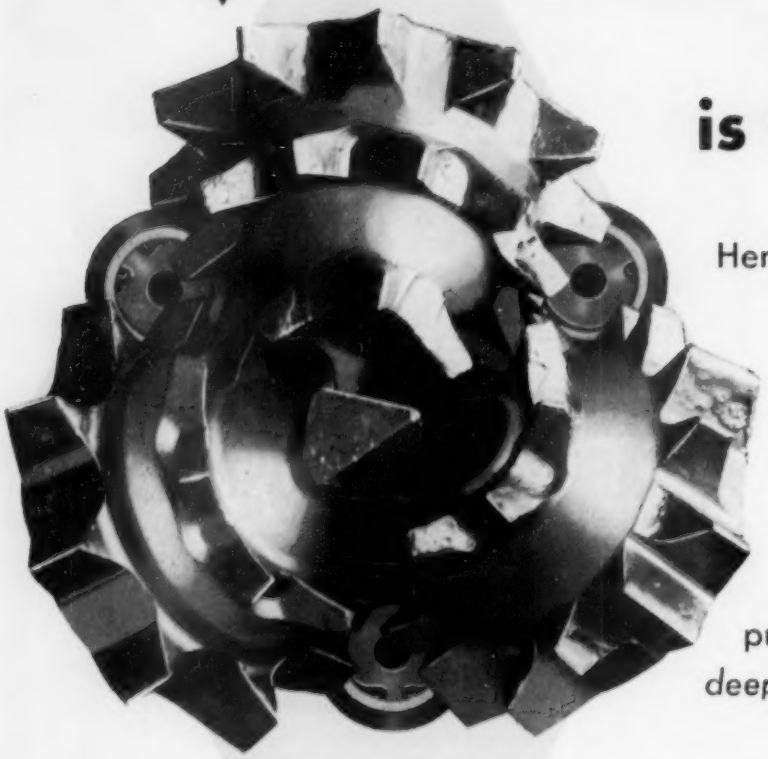
"Varec"

Compton, California, U. S. A.

Cable Address: Varec Compton Calif (U.S.A.) All Codes

"Nothing Beats a Globe for DURABILITY"





GLOBE TYPE "SS3C"

Quality is the reason

Here's the biggest bundle of high-powered digging performance ever offered an ambitious tool pusher. The best in design, engineering, materials, and manufacturing precision, gives you *faster, deeper hole for your money!*

GLOBE

OIL TOOLS COMPANY

Serving the Petroleum Industry with the Best in Drilling Equipment

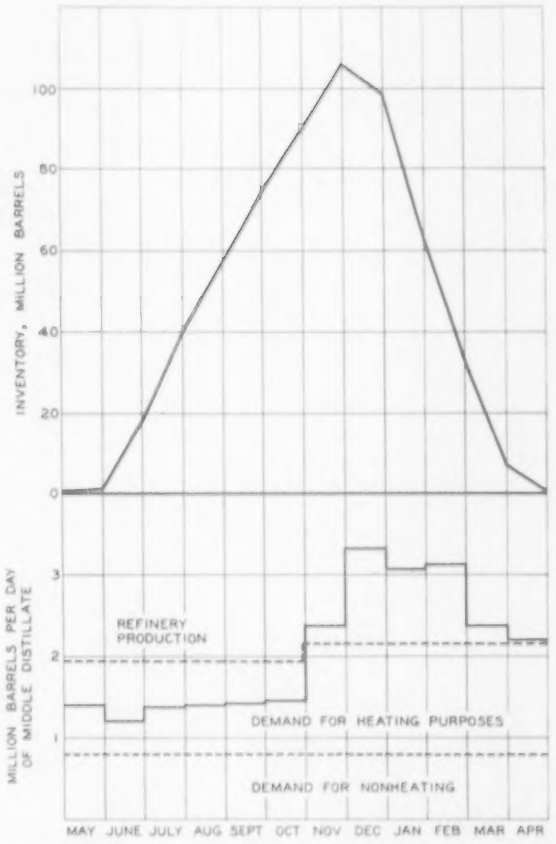
Main Office and Plant:
LOS NIETOS, CALIFORNIA
Branches are maintained in all principal drilling areas.

DEGREE-DAY FORECASTING

. . . why it's needed in the petroleum industry

"If seasonal area temperatures could be predicted, it is estimated that there would be a total saving to the industry of more than 100 million dollars. Even a partly improved forecast which will reduce the number of these costly refinery adjustments would be of value to the industry and provide a better protection of supply for the customer."

by W. J. Sweeney



YEAR-ROUND PLANNING required to meet normal heating-oil demand. Fig. 1.

MANY operations within the petroleum industry are seriously affected by weather. Notably important is the effect of weather on petroleum products used each year for residential heating.

A yearly expected demand for some 450 million barrels of these products is directly related to the severity of the heating season, and the actual demand in a cold season may exceed that in a warm season by as much as 125 million barrels. The industry has the responsibility of supplying its customers, regardless of the weather.

Peak winter demands for heating oil are met not only by production during the heating season but also from inventory that is built up during the summer. Operations in summer, fall, and early winter must necessarily be based on estimates of how cold the forthcoming heating season will be.

Industry policy is to meet heating demands, regardless of the severity of the winter season. It is conventional to plan for an average season and resort to costly, extraordinary refinery operations to provide "last minute" adjustments for the actual winter severity.

If seasonal area temperatures could be predicted, it is estimated that there would be a total saving to the industry of more than 100 million dollars. Even a partly improved forecast which will reduce the number of these costly refinery adjustments would be of value to the industry and provide a better protection of supply for the customer.

Weather forecasting also is vitally needed in marine, producing, pipeline, and other phases of the industry activities. In all these fields, better weather forecasts can be used to supply the needs of the customer with greater assurance and lower cost.

In past years, gasoline for the summer was the planning problem. In recent years, particularly in the northern and more populous areas, the major planning problem has been heating oils or middle distillates. In future years, with larger diesel and jet-fuel demands, as well as with increasing heating-oil demand, the problem of planning heating oil needs will become more acute.

Required planning . . . Fig. 1 indicates the year-round planning required to meet normal heating-oil demand.

Inventory is at a minimum in April. By the end of April, usually the refinery output of middle distillates will exceed the demands and the inventory in storage starts to build up. During the summer months, the sales of middle distillates are accounted for only by nonheating purposes and by secondary storage. During this period, the inventory is built up to take care of the anticipated demands of the coming winter. Maximum inventory is in tankage in November; and for the period November through March, sales are met from inventory as well as from current production.

The refiner has several reasons to keep production reasonably constant during the year. First, it is most economical to maintain a rather uniform production rate throughout the year. Secondly, this provides more flexibility, either to increase production in cold winters or to reduce production in warm seasons.

For some time, the petroleum industry has been aware of the effect of weather, specifically temperature, measured in degree-days, over the heating

Author is vice president, Esso Research & Engineering Co., New York. Paper presented at A.P.I. annual meeting, Chicago, November 12, 1956, under the original title "Importance and Need of Degree-Day Forecasting for the Petroleum Industry."

season on the consumption of burning oils in the United States. Total degree-days in the heating season are the sum of daily degree-days, i.e., the number of degrees below 65 for each day. These seasonal degree-days give a fairly accurate measure of the amount of heating oil and range oil that will be consumed for heating purposes.

Degree-day data . . . Fig. 2 shows the New York, N. Y., degree-day data since 1870.

In this chart, the vertical bars show the degree-days for each heating season. The heavy line shows the long-term trend towards warmer weather, indicating that the New York average seasonal degree-days have decreased from about 5,650 degree-days in 1870 to under 5,000 at present.

While there is a trend towards warmer winters, individual heating seasons show wide fluctuations from year to year. For example, during the past 25 years, the coldest heating season in New York was 1939-40, with the average temperature in degree-days 10.1 per cent colder than the average for the past 50 years.

The warmest season was 1948-49 with the average temperature 18.7 per cent warmer than the 50-year average. Therefore, in the past 50 years, the degree-day totals for individual heating seasons in New York have varied over a range of 28.8 per cent of the 50-year average.

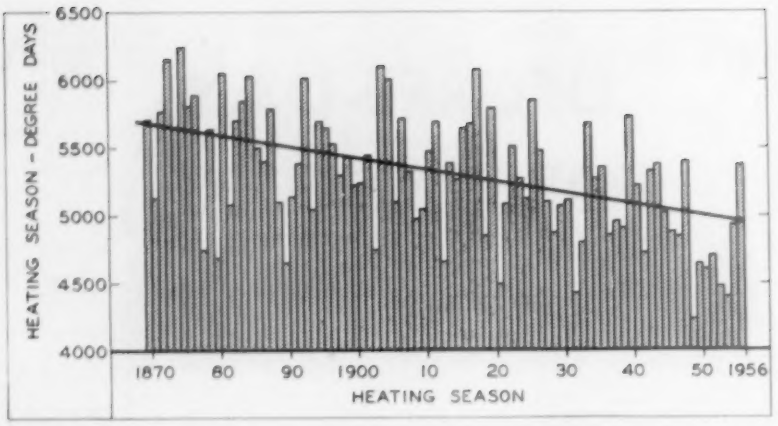
The range of variation in degree-days between coldest and warmest seasons is roughly the same for the United States as it is for New York City. This means that the demand for middle distillates in the coldest seasons might exceed that in the warmest by as much as 125 million barrels.

This is equivalent to a variation of 700 thousand barrels per day in industry demand over the 6-month heating-season period. These figures may be regarded as rough measures of the range within which demand may fluctuate unpredictably due to weather.

Inventory requirements . . . The requirements of inventory in the petroleum industry needed to meet the unusually cold or warm season are shown in Fig. 3.

The additional sales of heating oil during a cold winter must be met by additional inventory as well as by increased production during the heating season. The inventory on hand in September must be such that in a cold winter we will not run out of oil during the heating season. Therefore, for normal weather, considerable oil will be in storage at the end of the winter.

The maximum tankage must provide for additional inventory that is built up in October and November when the demand is less than expected due to unusually warm fall weather. Tankage space above that required for normal weather must be available to take care of this possible inventory buildup.



TREND OF WARMER WEATHER—New York City degree-days, 1870-1956. Fig. 2.

As a practical situation, we have some limit on the available tankage above the normal inventory peak in November and a limit on the available oil in storage below the normal dip in April. The "normal" inventory level for the month is always the safest level. With proper planning, the normal level allows for the possibility of either very cold or very warm months to follow.

In other words, we are trying to walk a tight rope. If inventory overflows capacity before November, we are in trouble; likewise, if it is too high in April, we will have extra expense during the summer, cutting production to abnormally low levels by recracking, etc. If inventory runs too low through November, or dips too much below normal level at any time during the season, we are in for a shortage problem if the ensuing months are cold.

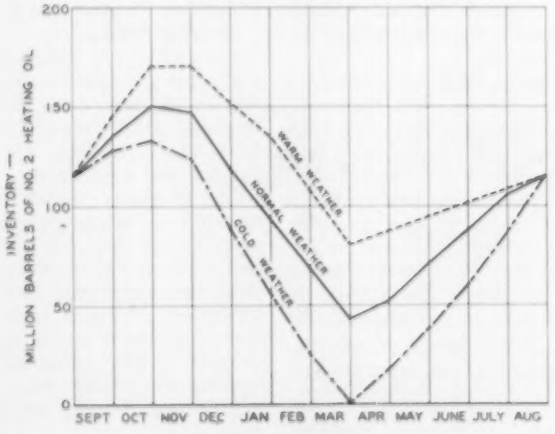
Without adequate forecasts, the month-to-month readjustment in refinery runs can be made only on the basis of weather that has occurred. Seasonal forecasts of degree-days could be used to assist the periodic readjustment of refinery runs during the season.

By continually planning our readjustments in advance of the weather, using both the improved forecast and the necessary adjustments for the cold or warm months that have occurred, we can keep our inventories at safer levels on the average than with adjustments based only on the weather which has happened.

The schedule of production would not rely on a single preseason forecast. Rather, we would use each series of forecasts obtained during the season and presumably could correct by after-planning and by use of subsequent forecasts for errors made in one or two of these forecasts.

Tankage and inventory . . . The tankage and average inventory for three cases are summarized in Table 1.

Each case involves exactly the same



INVENTORY of heating oil. Fig. 3.

PETROLEOS MEXICANOS

Gas Processing Plant

REYNOSA, MEXICO

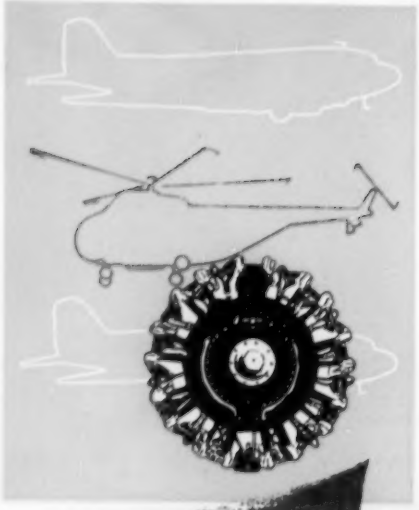
Below the Rio Grande, near Reynosa, in Tamaulipas, Mexico, Petroleos Mexicanos has recently completed this major gas processing project designed to process 300 million cubic feet of natural gas daily gathered from numerous fields within an area of about 400 square miles. About 8,000 barrels per day of fractionated products, including propane, butanes, motor fuel, naphtha and kerosene will be produced.

Engineering design and procurement of equipment was entrusted to Hudson, and the satisfaction of our client is attested by a current contract for a similar but even larger project for Petroleos Mexicanos on the Isthmus of Tehuantepec.

DESIGNERS AND CONSTRUCTORS OF
OIL AND GAS PROCESSING PLANTS

HUDSON
ENGINEERING CORPORATION

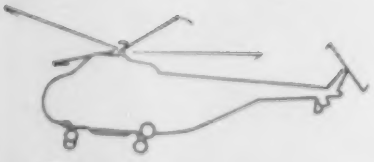
FAIRVIEW STATION • HOUSTON, TEXAS



If

IF you have anything to do with airplanes or helicopters, then you probably have something to do with Engines . . . AND IF you have anything to do with Engines, you *SHOULD* have something to do with *DALLAS AIRMOTIVE.*

Member National Business Aircraft Association



Home of Reliable Engines

DALLAS AIRMOTIVE INC.

New York Office:
1219 Marine Terminal Building
La Guardia Station
Flushing 71, N. Y.

Washington Office:
Woodward Building
711 15th Street, N.W.
Washington, D.C.

6114 FOREST PARK ROAD

ELmhurst 3771 • DALLAS, TEXAS

TABLE 1

	Required storage		Average inventory	
	Million barrels	Per cent of yearly demand	Million barrels	Per cent of yearly demand
CASE 1:				
No forecast used—no adjustment of production rate during the season	185	41.0	108	24.0
CASE 2:				
No forecast used—monthly adjustment of production rate after cold or warm weather occurs	167	37.0	98	21.7
CASE 3:				
Use of 50 per cent improved 3-month forecast—monthly adjustment of production rate, based on forecast and previous weather	140	31.0	78	17.3

risk of incurring additional expense to meet demands. In Case 1, no forecast is used, and no adjustment of production rate is made during the season. This requires tankage availability to take care of 41 per cent of the yearly demand of heating oil and an average inventary of 24 per cent of the yearly requirements.

Case 2 is based on no forecast, but does include a monthly adjustment of production rate after warm or cold winter weather occurs. In this case, 37 per cent of the yearly demand is required as available tankage, and the average inventory is 21.7 per cent of the yearly requirement.

In Case 3, an improved 3-month forecast is used and monthly adjustments of production rate are scheduled, based on forecasts and on the previous weather. In this case, tankage equaling 31 per cent of the yearly demand must be available, and the inventory is 17.3 per cent of the yearly demand.

The comparison of Case 1 and Case 2 has been shown to indicate the advantage of monthly planning even without the use of temperature forecasts. The comparison between Case 2 and Case 3 indicates the value of the improved forecast. Using these figures, it is estimated that the improved forecast might be worth the values shown in Table 2.

TABLE 2—REDUCTION IN TANKAGE AND INVENTORY WITH IMPROVED FORECAST

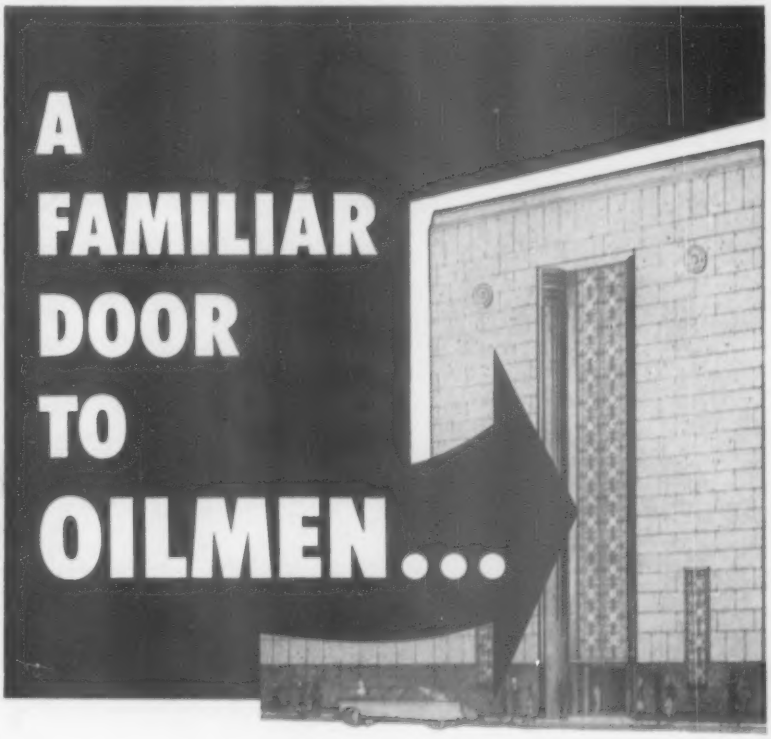
Tankage (6.0 per cent of yearly demand):	
27 million barrels at $1.50 per barrel	$40,500,000
Inventory (4.4 per cent of yearly demand):	
20 million barrels at $3.00 per barrel	60,000,000
Total	$100,500,000

The figures in Table 2 show a reduction in tankage costs of 40 million dollars and a saving in capital tied up in inventory of 60 million dollars, giving a total saving for the industry of 100 million dollars.

It is felt that this estimate of the value of improved forecasts, while very rough, is also very conservative, because it is based only on tankage savings. Based on actual operations as of today, many high cost operations are required to meet unseasonable demands. A good forecast would result in lower manufacturing costs, and on this basis the potential saving would be very much larger.

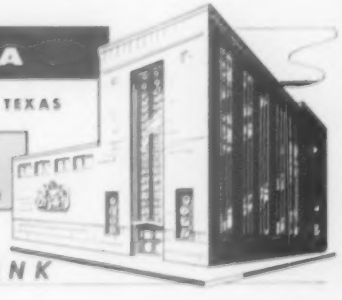
Meeting demand . . . Theoretically, the industry could provide for the demand for heating oil without large inventory if it built sufficient refining capacity to make all of the requirements during the heating season. If this were done, large amounts of standby refinery capacity would be needed to provide for the heating-oil demands as they occurred.

In order to do this, over 1½ million barrels per day additional refining capacity would have to be constructed



It's the door to Victoria Bank and Trust Company, of course; a door widely used by oil men who rely on our Oil and Gas Department to solve their financing or investment problems.

For a bank with specific knowledge and facilities to meet your needs, consult the Texas' Golden Gulf Coast oil bank . . .



VICTORIA
BANK & TRUST CO.
VICTORIA, TEXAS
MEMBER FDIC
A PROGRESSIVE BANK

at the cost of over 1 billion dollars. This equipment would be used on a part-time basis and would be costly to the industry and costly to the public.

Rather than have this large amount of standby capacity, the industry has found instead that it is better to build up heating-oil inventory during the summer as a cushion for the large winter demands. In order to meet the requirements of unusual weather at the minimum cost to the industry and the minimum price to the consumer, great efforts are made within the industry to achieve the proper balance between month-to-month changes in refinery operations and available heat oil in inventory throughout the year.

The use of weather forecasting to supplement present methods of scheduling by the petroleum industry must provide assurance that the industry will be able to supply the heating-oil customers with their requirements. One objective must be that no greater risk is taken of running out of heating oil when plans are based on a long-range forecast than there is now.

Our studies have shown that even a partially successful forecast, continually corrected by afterplanning during the season, can reduce the risk of running out of heating oil during a cold season. A reasonable forecast could considerably reduce the danger of finishing a winter season with full tanks and with no place to put the production which must take place in the summer.

Alternatively, the forecast could be used to reduce costs while taking the same risks that are necessary today. In the final analysis, a good weather forecast would probably be used to accomplish both of these objectives.

Other needs . . . The value of heating-oil scheduling is, in fact, only one facet of the wide interests and needs of the petroleum industry for long-range weather forecasting. Weather forecasting is vitally needed in marine, producing, pipeline, and other phases of the industry's activities. In all of these fields, the forecasts can be used to supply the needs of the customer with greater assurance and lower cost.

While weather is a subject of great importance in the public eye, and there is a great deal written on the subject, it is interesting to observe that the cost of the total actual research being carried out in the field of long-range weather forecasting is perhaps in the order of 0.2 per cent of that carried out by the petroleum industry on petroleum-refining research.

Further, the proportion of this relatively limited over-all work on long-range weather which is being carried out on the kind of temperature forecasting of interest to the petroleum industry is sufficiently small that a project in the order of $25,000 to $50,000 per year would constitute a major project of its kind in the field and would be sure to be recognized as such.

Some of the accomplishments expected of A.P.I. sponsored long-range weather projects are:

1. The project will present to the industry the best information on the average temperatures they can expect in various localities together with the deviations from this average temperature that might be expected at a given probability level.

2. The project on long-range weather forecasting will tell us with what reliance we can accept the various types of forecasts which are offered from time to time.

3. The A.P.I. project will convince the weather people that the problem of long-range temperature forecasting is one of significant interest to the petroleum industry and will tend to direct their thinking in such a direction.

4. The project will give us some concrete idea of whether or not we have some chance of developing a really improved forecast.

5. The A.P.I. sponsored project will probably develop a somewhat improved forecasting technique for our purposes as compared to any now currently available.

NEW
SINGLE PHASE 10, 15 and 20 HP
R & M "All-Weather-40"
Oil Country MOTORS
Famous R&M "All-Weather-40" motors are now available for single phase operation in sizes up to 20 HP. All auxiliary mechanism is externally mounted for simple inspection and servicing, even while the motor is running. R&M "All-Weather" features protect against moisture and assure dependable operation for years of oil field duty.
A unique part winding "cushion start" system, available as an extra-cost option, provides reduced current starting for sizes above 7½ HP.
Get all the facts now on R&M "All-Weather-40" single phase motors. Write for Bulletin 470-AGJ or call your R&M representative.
R&M
ROBBINS & MYERS, INC.
Motor Division • Springfield, Ohio

How far down the road is

Reliable Long-Range Forecasting?

Answer depends on success of three approaches . . . (1) statistical, (2) physical-synoptic, (3) solar variability

by Hurd C. Willett

IT APPEARS that in the presently foreseeable future, forecasting on a monthly and seasonal basis will be practical only in terms of mean conditions and trends, not at all on a detailed day-to-day basis. Possible approaches to long-range forecasts of this practical type may be classified in three categories, as follows:

1. The purely statistical approach, utilizing past weather data without any physical interpretation.

2. The physical-synoptic approach, involving the analysis and physical interpretation of past weather patterns, and their changes.

3. The solar variability approach, involving the possible influence of sunspots or other forms of variable solar activity on the world-weather patterns.

I feel that the best estimate of the potential benefit of each of these approaches to the indicated type of practical long-range forecasting may be summarized briefly as follows:

1. The maximum practical benefit of the purely statistical approach probably will be realized within a period of about 5 years, depending upon the amount of support for necessary research. It is reasonable to hope that this approach may double the present slim margin of skill of such forecasts over a random guess, raising this margin from an upper 20 per cent limit at present to a possible 40 per cent limit, where 100 per cent represents a perfect forecast.

2. Most of the practical benefit of the physical-synoptic approach probably will be realized within a period of 10 years, depending again upon the research support. It is estimated that the combination of these approaches with the purely statistical may raise the margin of prognostic skill from an upper 40 per cent limit to something in the 50 to 60 per cent range.

3. The possibile influences of variable solar activity on the world-weather patterns will be more difficult to evaluate, requiring possibly as much as 20 years of effective solar-weather research to establish in specific terms. It is my opinion, however, that these solar influences are important and may be expected, eventually, to raise the prognostic margin of skill from the 50 to 60 per cent range to 70 per cent or possibly even better.

The author is professor of meteorology, M. I. T. Paper presented at annual A.P.I. meeting, Chicago, November 12, 1956, under the original title, "Prospects for Reliability in Long-Range Forecasting."

Long-range forecasts . . . The term, "long-range," refers primarily to forecasts of monthly or seasonal departures from normal of temperature and rainfall, or possibly of other weather elements, as averaged over state-wide areas. Because of variable local influences, single-station forecasts of monthly or seasonal anomalies cannot be pin pointed with as great a degree of accuracy as can be attained by state-wide forecasts.

In addition to monthly or seasonal departures from normal, long-range forecasts can deal with long term trends or major shifts of the weather regime within the forecast periods, but they definitely cannot successfully deal with the day-to-day sequence of warm or cold, of rain or shine.

This type of forecast of the detailed day-to-day weather sequence over an extended period of time is referred to as an extended weather forecast. There is no prospect at the present time of extending the range of significant skill of such forecasts beyond the present extreme limit of 5 to 7 days. Hence, the extended type of forecast is strictly excluded from consideration in this discussion.

In order to express an opinion as to the present or future reliability of long-range forecasts, it is necessary to define the terms in which this reliability is measured. Obviously it serves no purpose to say that forecasts are 75 per cent correct, unless the limits of tolerance or the manner of establishing correctness is defined.

Without giving more time to this rather technical question, it need be said only that in the following remarks the reliability of prediction is expressed in terms of percentage of skill, or that percentage of the total variability of the forecast element which the forecast expresses over and above that which would be expressed by pure chance or uneducated guesswork.

Take, for example, the simplified problem of forecasting only whether the temperature next month will average above or below the normal. A random guess will, in the absence of a significant long-range trend be right 50 per cent of the time, and wrong 50 per cent of the time. If a forecaster is right 75 per cent of the time, he has forecast half of the total variability over and above pure guesswork. In other words, he has a skill score of 50 per cent. On such a skill-score basis the ordinary 24-hour forecasts for tomorrow's weather will generally fall in the 60 to 80 per cent range, depending upon the weather-element forecast, the season of the year, and the geographical area involved.

How good are forecasts? . . . On this basis, how good are present long-range forecasts? How good may they be expected to become within the foreseeable future? It should be emphasized at the start that there definitely is not available any extensive objective verification of a variety of a long-range forecasts on any comparable or readily interpretable basis.

Consequently the following estimates even of current long-range prognostic performance are based entirely on my personal experience and judgment, hence can be only approximate in character. Similar estimates of prospective future performance obviously are even more a matter of personal judgment and are bound to be more highly approximate and controversial in character.

It appears from all of the best available evidence that with one possible exception which requires further verification, none of the long-range forecasts, issued currently or in the past by either public or private commercial

agencies, have consistently exceeded a skill verification of approximately 20 per cent. Most of these forecasts verify below rather than above this figure.

This is a performance which can be approximately equaled in many cases by making use of straight persistence, or continuation of the present departure in forecasting for the following period, a procedure which cannot properly be called forecasting, but rather the substitution of an educated guess for a random guess.

The methods which have been in general use up to the present in the preparation of these long-range forecasts that fail to exceed significantly the performance of straight persistence, include primarily techniques of purely statistical extrapolation, analog comparison or forecasting by the selection of similar cases in the past, and the persistence and modification of the current weather departures from normal.

What sort of skill performance by long-range forecasts of the type under discussion is it justifiable to hope for within the foreseeable future? It is my considered opinion that the skill verification of forecasts of monthly and seasonal mean departures from normal of temperature and trend of departure reasonably may be expected to approach or possibly to exceed the 70 per cent level within a period of 10 to 20 years.

The exact length of this period will depend largely on the extent to which the necessary research is supported, and on the availability of high-speed computing equipment. Forecasts of precipitation probably will be somewhat less accurate than those of temperature.

This estimate of skill performance reasonably to be expected of long-range forecasts constitutes in itself a long-range forecast, based on the consideration of three possible approaches to the problem. There follows a brief discussion of the outlook for each of these possible approaches, which may be described in the following terms:

1. The meteorological statistical approach, utilizing in general form without physical interpretation past observational weather data which are currently available or becoming available.

2. The physical-synoptic approach, involving the interpretation and understanding of the normal internal mechanics of the operation of the general circulation of the atmosphere, i.e., the attempt to understand the customary working of the large-scale wind systems of the earth's atmosphere.

3. The solar variability approach, involving the influence of any irregularly variable external (solar) factor of control of the general circulation, such as sunspots or other variable solar phenomena.

1. The Meteorological Statistical Approach (Use of Past Weather Data)

The principal advantage of the purely statistical approach to long-range forecasting lies in the fact that the available meteorological data approach adequacy, at least for the satisfactory development and testing of the comprehensive forecasting techniques currently under development.

Since these techniques are in no sense dependent upon physical or theoretical understanding of the statistical relationships that are uncovered, the attainment of maximum results will not be delayed by the necessity of further extensive accumulation of data nor development of theory.

The most comprehensive statistical technique, which currently is under development, depends essentially on the statistical determination of just how the variation of past weather patterns is related to the weather that follows. Insofar as past weather patterns do determine those to come, in any general long-range statistical sense, and therefore do have long-range forecasting significance, this technique, properly

This rugged new engine has been added to the Wisconsin line to fill the horsepower gap between the Model VF4 25 hp. and the Model VG4D 36 hp. Wisconsin Engines. At the same time, the mounting base is dimensionally identical to the Models VE4 and VF4 to permit convenient replacement of the latter engines if greater power is required.

The Model VH4, which now makes its bow for the first time, is the most powerful engine of its type and size available today, in our estimation. It is an engine of basic High Torque design which gives it the important advantage of being able to deliver maximum usable *Lugging Power* that carries the load through the hard, heavy pulls. It has been designed to give you the best possible performance at all engine speeds from 1400 to 2800 rpm., even when operating under intermittent shock-loads or under constant load, continuous service.

The Model VH4 is a heavy-duty engine in all respects, built for hard service under all operating conditions, at temperatures from sub-zero to 140° F. (60° C.). It is an exceptionally smooth-running, even-firing engine and has all the traditional heavy-duty features that characterize *all* Wisconsin Models, from 3 to 36 hp. It can be supplied as an "open engine" with side-mount fuel tank, or as housed power unit and may be equipped with electric generator and starter (or starter only), clutch, reduction or clutch-reduction assemblies . . . and is adaptable to operation on a variety of fuels such as gasoline, kerosene, natural gas, Butane, Propane or fuel oil of 35 Octane rating or better.

Learn more about this new engine. Write for Bulletin S-196 for detailed data and engineering specifications.

WISCONSIN MOTOR Corporation
MILWAUKEE 46, WISCONSIN
World's Largest Builders of Heavy-Duty Air-Cooled Engines

WRITE TO HARLEY SALES CO.
619 SOUTH MAIN STREET • TULSA, OKLAHOMA
3420 McKINNEY AVENUE • HOUSTON, TEXAS
808 SOUTH MAIN STREET • WICHITA, KANSAS
OIL FIELD DISTRIBUTORS FOR WISCONSIN ENGINES AND ALL TYPES OF UTILITY UNITS

applied, will develop the full prognostic value of the statistical relationships.

In other words, we have here a purely statistical long-range forecasting technique which is capable of realizing the ultimate prognostic success that is possible from the existing degree of determination of future weather patterns by preceding patterns of the weather and its variability. The general technique to be followed is clear in principle, the remaining problem is to find the manpower and the high-speed computers necessary to perform the vast amount of computational work, selective application, and testing that are required.

Probably the principal practical benefit of this generalized statistical approach to the problem of long-range forecasting will be realized within 3 to 6 years, depending upon the degree to which current support of this research is stepped up. When this job is completed, the possibilities of purely statistical long-range forecasting of future weather from past weather will be essentially exhausted. No such general approach to the problem has been possible in the past, because only now are the necessary high-speed computers becoming available.

How much will this statistical technique add to the present performance of long-range forecasting? The answer to this question lies in the degree to which current and past patterns of the weather and its variability determine future patterns on a monthly and seasonal basis. I am inclined to be rather conservative in my estimate of the degree of this control, anticipating perhaps a doubling of the present skill performance of such forecasts, roughly from 20 to 40 per cent.

This estimate rests on the conviction that the greater part of the variability of the future weather patterns is determined not primarily by the current state and past behavior of the general circulation but rather by the variable distribution and effectiveness of the primary regions of the heating and cooling of the atmosphere.

The existence of such long-term variable factors of weather control already has been conclusively demonstrated by a lack of long-term statistical consistence in the behavior patterns of the general circulation, on which world-weather conditions depend. In other words, the fact that given the same start weather patterns develop differently on different occasions proves that some factor of control is operating which is not determined by the initial weather pattern itself.

2. The Physical-Synoptic Approach

Any ultimately satisfactory technique of long-range forecasting must make allowance for this changing pattern of the behavior of the general circulation. Techniques seeking to do this look for the causes of this changing behavior pattern either exclusively in the internal physical mechanics and thermodynamics of the operation of the general circulation, that is, in the purely internal working of the system, or in the operation of this internal mechanism in combination with an important external factor of control exercised presumably by irregular solar activity such as sunspots.

Whether such an important irregularly variable solar factor operates or not, it is obvious that a better understanding of the internal mechanics of the general circulation is a first requirement for more effective long-range prediction and for the proper evaluation of any variable solar influence which may be superimposed. The so-called physical-synoptic approach, which is concerned solely with the internal mechanics of the general circulation, allow for only the normal seasonal fluctuations of solar heating in combination with variable terrestrial factors. These factors, all of which may influence the sun's effectiveness, include sea surface temperature, snow cover, and cloudiness.

Extensive current research in the physical-synoptic approach to long-range weather prediction is attempting

THE IMPROVED
WmSON-HILLCO MODEL 100
TAPPING MACHINE

SHORTER LENGTH permits
Taps in limited spaces

COMPACT, RUGGED DESIGN
Insures longer life

HIGH PRESSURE—HIGH TEMPERATURE
(1,440 psi @ 100°F or 700 psi @ 700°F)

TAP SIZES: 2" & Smaller

MODEL
100-B

For the Plant and Field . . .
Three other sizes of
WmSON-HILLCO Tapping Machines

MODEL 360
Taps to 6"—Hand operated

MODEL 660
Taps to 16"—Power operated

MODEL 1200
Taps to 36"—Power operated

MAXIMUM RATING, EACH MACHINE: 1,440 psi @ 100°F or 700°F @ 700 psi

Write for literature

T.D.Williamson,Inc.
P. O. BOX 4038 TULSA 9, OKLAHOMA
REPRESENTATIVES: HOUSTON • PITTSBURGH • PLAINFIELD, N. J. • AMARILLO • JOLIET, ILLINOIS • LOS ANGELES • SAN FRANCISCO • BARTLESVILLE, OKLA. • SEATTLE • EDMONTON, LONDON, ONT. • CALGARY • VANCOUVER, B.C. • BUENOS AIRES • CABIMAS, ZULIA, VENEZUELA • DURBAN, NATAL, SOUTH AFRICA • PARIS, FRANCE

to combine these physical factors with the theoretical hydrodynamics of the general circulation. These factors must include the variable frictional effects of land and sea surface and mountain barriers, and also the thermodynamic effects of primary sources of the heating and cooling of the atmosphere.

Important supplementary contributions to this theoretical research are being made in hydrodynamic laboratories by model experiments (of the rotating tank or dishpan variety), and in the high-speed-computer laboratories by the numerical computation of selected idealized models of the working of the circulation of the atmosphere. For the first time, it now appears that real progress is being made toward the theoretical solution of some of the basic problems of the general circulation with which in the past it has been possible to deal only empirically, on the basis of observational experience.

Extensive theoretical and experimental research in this physical-synoptic field, including some practical forecasting application, is in progress at a number of government and academic centers of meteorological research. As yet, however, it has not been brought to the point of effective practical contribution to long-range forecasting. This lack of practical results reflects only the complexity of the problem and the recency of its effective study, not at all any lack of the basic practical significance of the research.

The physical-synoptic approach to long-range prediction obviously will require a longer time than the purely statistical approach for full development to maximum effectiveness, because it depends on concepts which only now are being formed. Before being perfected for practical application to long-range forecasting, these concepts will require further analysis of world-wide weather observations.

More research . . . Probably from 5 to 10 years will be required, depending again upon the extent of the forthcoming support of the necessary research, to realize the greatest part of the practical benefit to long-range prediction of the physical-synoptic approach currently under development or consideration. The contribution that this type of basic research will add to the skill performance of long-range forecasts is quite problematical at this stage of its development.

This contribution will depend upon the extent, still to be determined, that the development of the world-wide weather patterns is found to be a problem purely of the internal working of the system, or to be to a significant degree influenced by sunspots or other solar activity. I believe that the best practical use of the physical-synoptic approach to long-range forecasting might lift the skill performance of such forecasts from the 40 per cent ceiling, which may be attainable by the purely statistical approach, to a performance somewhere in 50 to 60 per cent range.

This estimate is based on the conviction that irregular solar activity, such as sunspots, will be found frequently to exert an important influence of extra-terrestrial origin on the large-scale weather developments.

3. The Approach Involving Irregular Solar Activity

Even if sunspots and other such irregular solar activity only occasionally exert a decisive influence on the large-scale changes of the world's weather patterns, it is important for the long-range forecaster to be aware of this possibility and of the effects to be expected. If it is a controlling factor of primary significance, then it will be necessary to determine the specific nature of the active solar emission, and to reliably establish the physical connection between solar emission and ultimate reaction of the world-weather patterns.

At the present time there is considerable difference between the statistical confirmation of long-term sunspot in-

WHEELING
COUPLINGS
FOR OIL COUNTRY USE
LINE PIPE COUPLINGS A.P.I.
⅛" to 12"—Seamless
Black or Galvanized
PLAIN TUBING COUPLINGS A.P.I.
1" to 4"—Seamless
EXTERNAL UPSET TUBING COUPLINGS A.P.I.
⅜" to 3½"—Seamless
CASING COUPLINGS A.P.I.
4½" to 13⅜"—Seamless Long or Short
HYDRAULIC COUPLINGS
⅛" to 4"—Seamless
REAMED AND DRIFTED A.I.S.I.
¼" to 12"—Seamless
DRIVE PIPE COUPLINGS
6" to 12"—Seamless
TOP QUALITY Since 1918
Sales Offices in Leading Cities
Albany, N. Y.—Albert L. Becker, 434 Clinton Ave.
Baltimore, Md.—William H. Thurlow, 2301 No. Charles St.
Chicago, Ill.—Harry A. Jay, Suite 1090, Old Colony Bldg.
Denver, Colo.—Earl H. Jones & Co., 1863 Waxee St.
Detroit, Mich.—R. W. Lang, Jr., 505 Park Ave.
Erie, Pa.—R. J. Maggi, Box 711
Falmouth, Mass.—Walter S. Bennett, 53 Minot St.
Grand Rapids, Mich.—R. W. Lang, Jr., 138 Burton SE
Houston, Tex.—Henry H. Paris Distributor, Inc., Box 932
Independence, Mo.—Craig A. Fross, 3701 Norwood
Los Angeles, Calif.—James A. Riordan Co., 1400 Santa Fe Ave.
Louisville, Ky.—Sid Schultze Co., 514 West Main St.
Milwaukee, Wis.—W. G. Nelson, 3347 N. 97th St.
Norberth, Pa.—J. W. Worthington, 105 Forrest Ave.
Newark, N. J.—Ira L. Rothenberg & Assocs., 398 Market St.
New York, N. Y.—Max Rothenberg, 11-05 38th Ave., Long Island City
Omaha, Nebraska—Wm. Preiden, Central States Engineering & Sales Co., 5101 Blondo St.
Oswego, N. Y.—Northeastern Associates, Inc., Neil Chatterton, Sec'y., P. O. Box 284
Portland, Ore.—Earl H. Jones & Co., 1233 NW 12th Ave.
Richmond, Va.—P. C. Abbott & Co., 15 E. Franklin St.
St. Louis, Mo.—Walter C. Dollinger, Dollinger & Lucas, 1047 Big Bend
San Francisco, Cal.—Earl H. Jones & Co., 1150 Folsom St.
Seattle, Wash.—Earl H. Jones & Co., 819 Thomas St.
WHEELING MACHINE PRODUCTS COMPANY
WHEELING, WEST VIRGINIA
Factories at WHEELING, W. VA. and WOODLAKE, CALIFORNIA

fluence on climate and that of the suspected short-term reactions of the weather patterns to sudden solar disturbance.

A. Long-Term (Climatic) Sunspot Influence on Weather

More than half a century of statistical analysis of sunspot and weather data has established, almost beyond statistical doubt, the existence of significant relationship between solar activity as represented by the various sunspot cycles, and fluctuations of the world-weather patterns as reflected in climatic cycles or climatic trends.

In particular, the long-term fluctuations of temperature in north polar latitudes, which are reflected less strongly in the temperatures of the higher middle latitudes in many regions, are closely related to a sunspot cycle of about 80 years. Also, alternating wet and dry decades in the western United States and other sections of the lower middle latitudes of both hemispheres are closely related to the double, or 22-year sunspot cycle. At the same time, temperatures in most of the tropics show a significant inverse parallelism to the single 11-year sunspot cycle, i.e., cooler temperatures go with higher sunspots.

A great deal, which can be extremely useful for decadal or even longer-range prediction of climatic trends or fluctuations, remains to be established concerning the complete pattern of these longer-term solar weather relationships. However, studies of this category can be useful only very indirectly for monthly or seasonal forecasting, or for the determination of the specific physical connection between variable solar emissions, such as the ultraviolet and electrical radiations the responses of the general circulation of the troposphere (lower atmosphere).

B. Short-Term Reactions of Weather to Sudden Solar Impulses

In spite of rapidly mounting evidence in recent years of specific large-scale reactions of the world-weather patterns to particular solar outbursts, the record of such occurrences is so recent and so few in number that their reality is generally questioned. On the other hand, it is entirely reasonable to assume that if an average degree of disturbance of the sun over a period of time can produce an average departure from normal of the weather, then specific solar outbursts should produce specific weather reactions. Significant statistical confirmation of this assumption has recently appeared.

The problem of the physical cause of all solar-weather relationships and the proper use of the solar factor in long-range prediction will be answered satisfactorily only when the specific

how to

CUT CORROSION LOSSES

a report by Koppers Company, Inc.

W. F. Fair, Jr.
Corrosion Consultant

The two most recent reports in this monthly series have stressed the importance of good surface preparation and described methods used to clean metal surfaces prior to the application of protective coating systems. This report describes an experiment, conducted under service conditions, which illustrates striking differences in coating performance due solely to differences in surface preparation.

* * *

In 1952 speculation arose concerning the contribution of wash primer surface conditioners and of inhibitory pigmented primers, when used with coal tar coating systems. Dr. Joseph Bigos of the Steel Structures Painting Council, and editor of the Steel Structures Painting Manual, participated in the discussions, giving freely of his time and experience.

When it was decided to subject certain typical protective coating systems to an environment of known high corrosivity, two areas in the Koppers Coke Plant at Kearny, N. J., were selected. The location of this plant on tide water, fumes and "coke breeze" from adjacent ovens, saline condensation from the coke quenching, and seasonal temperature shocks assured rugged testing conditions.

The areas tested were an actifier tower and three oxide box tops, totaling nearly 5,000 sq. ft. of steel surface. Fourteen coating systems were applied in duplicate 2-foot-wide strips on the vertical actifier tower, after thorough sandblasting. Of the flat box top areas, half were cleaned by sandblasting and half by power wirebrushing, and the same fourteen coatings were applied on both of these differently cleaned areas.

Primers used were a conventional coal tar cutback, three wash primers, two epoxy red leads, two phenolics, four special proprietary formulations, and three experimental coal tar solutions. Barrier coats over primers were Bitumastic® No. 50, Bitumastic Super Service Black, and Bituplastic® No. 28. For comparison, unprimed sections received the same coatings. Bituplastic No. 28 was used to topcoat all areas.

* * *

At the end of only one year, all systems on the wire-brushed areas—both primed and unprimed—had blistered and soon showed universal disbonding. After two years, disbonding and undercutting on these areas had caused complete coating failure. Now, after more than three years, all the coating systems on the sandblasted areas—both primed and unprimed—are in perfect condition and show no signs of deterioration.

In such severe corrosion environments, it is obviously futile to consider any but the best surface preparation. Also, it must be concluded that priming cannot compensate for incomplete metal cleaning.

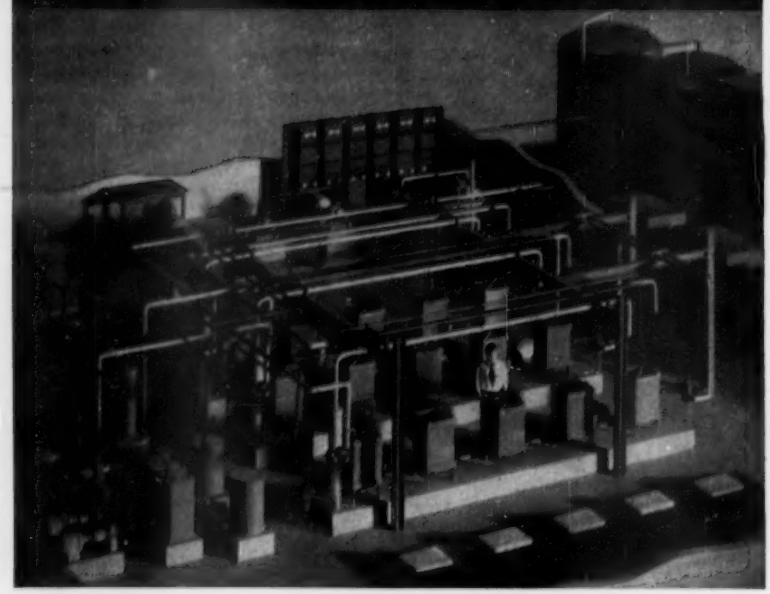
* * *

Our Technical Department makes semi-annual inspections of this continuing test. We'll be glad to notify you of these inspection tours if you would like to be present. Write Koppers Company, Inc., 1301 Koppers Building, Dept. 104L, Pittsburgh 19, Pa. District Offices: Boston, Chicago, Los Angeles, New York, Pittsburgh and Woodward, Ala. In Canada: Koppers Products, Ltd., Toronto, Ontario and Edmonton, Alberta.

KOPPERS

BITUMASTIC
REG. U. S. PAT. OFF.
COATINGS AND ENAMELS

FRESH WATER
...FROM A BRACKISH WELL



Fifteen months ago, an IONICS electric membrane plant began supplying part of the fresh water required for a drilling and refining community of 5000 people on oil-rich Bahrain Island in the Persian Gulf.

After only five months of operation the purchaser, a major petroleum company, decided to treble the size of the plant and rely on it completely for the community's needs—abundant proof of the reliability and economy of IONICS equipment.

The expanded plant, shown in this model, is now under construction with special allowance for future increases in capacity.

Specifics on the Bahrain plant:

Well water chemical analysis . . . . . *3100 ppm dissolved solids*
Product water chemical analysis . . . . . *450 ppm*
Electric energy consumption . . . . . *15 kwh per 1000 gallons*
Daily capacity—present . . . . . *28,800 gallons per day*
Daily capacity—final . . . . . *86,400 gallons per day*

The electric membrane plants remove salt, hardness, alkalinity, gypsum, epsom salts, nitrate and fluoride from natural waters.

They operate continuously, automatically, economically.

They require no steam, no periodic regeneration, and leave no hard scale deposits.

For additional information, write Department O.

IONICS

IONICS, INCORPORATED, 152 SIXTH STREET, CAMBRIDGE 42, MASS.

nature of the causative solar emissions and their complete physical connection to the resultant atmospheric weather changes are fully understood. This is the solar factor the exclusion of which is assumed (item 2) to limit the long-range forecast performance which is estimated as attainable by the physical-synoptic approach based on the purely internal working of the large-scale wind systems of the atmosphere.

A satisfactory understanding and the practical application to long-range prediction, of the role of the variable solar factor in fluctuations of the world-weather patterns, will require a substantial increase in our knowledge on three fronts, namely:

1. Specific information as to the quantitative output of the irregular solar emissions, both electrical and ultraviolet. To obtain this information reliably will require the accurate recording and study of a variety of indices or parameters of the state of disturbance of the sun.

2. Quantitative information as to the thermal and circulatory reactions of the upper stratosphere to solar ultraviolet and electrical bombardment. The entire problem of the elevation and the manner of the atmospheric absorption of this solar energy, of the immediate thermal and circulatory changes of the atmosphere at those levels, and of the transmission of these effects to lower levels, remains to be answered.

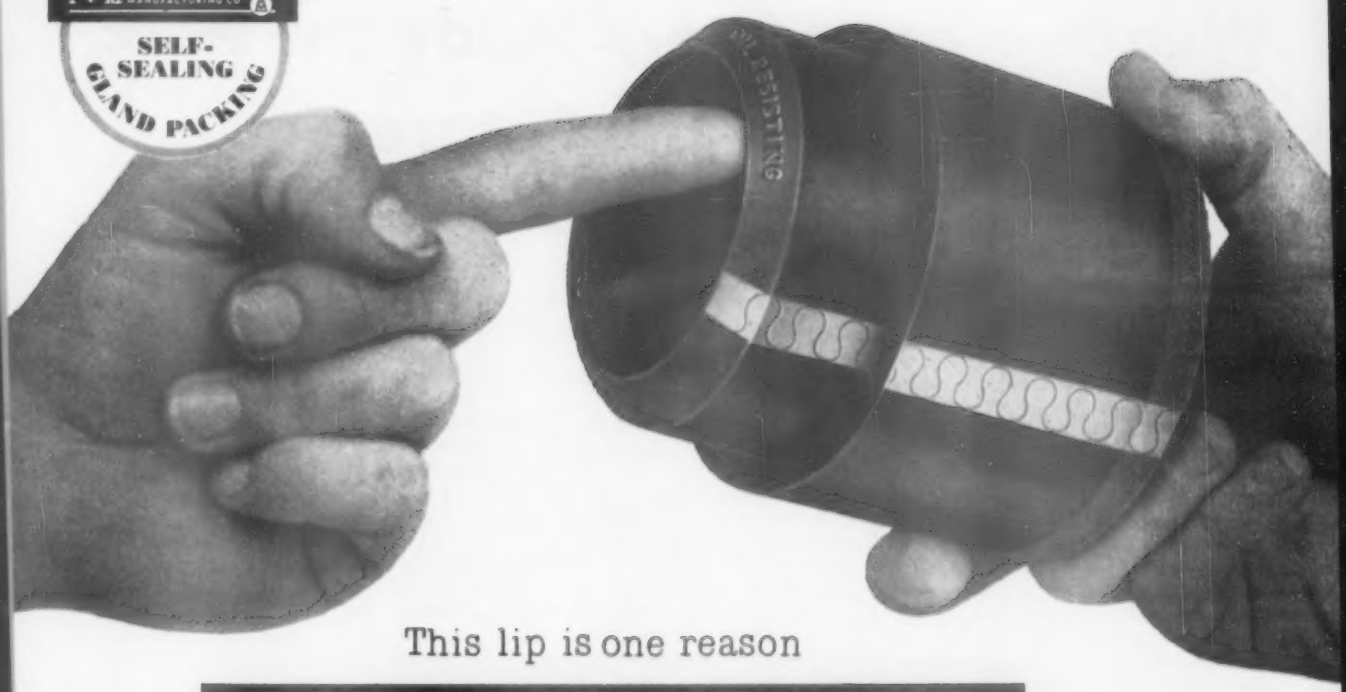
3. Accurate determination of the ultimate response of the circulation of the lower atmosphere (troposphere) to specific solar emissions. Obviously the final complete answer to this basic problem of long-range prediction will not be forthcoming until the internal working of the major wind systems and the physical connection, if any, between specific solar emissions and the transmission of their effects to the lower atmosphere are sufficiently well understood to explain any impact of the solar outburst on the wind system.

Meanwhile, however, partial experimental answers that may serve as a guide to the physical theory are obtainable by short-cut statistical analysis of solar and weather data.

It is evident that the complete evaluation of the influence of irregular solar activity on changes of the world-weather patterns and its most effective practical application to operational long-range weather prediction will require many years. But, at this point, the indications are strong that it will constitute an important contribution to such prediction. I believe it will require from 10 to 20 years to realize most of the practical contribution of solar-weather relationships to long-range prediction, depending again on support given to necessary research.

MISSION MANUFACTURING CO.

SELF-SEALING GLAND PACKING



This lip is one reason

Mission Self-Sealing Gland Packings

make piston rods last longer.

Pump pressure assures positive sealing on the pressure stroke without excessive gland tightening which causes unnecessary wear on the rod during the suction stroke.

Mission Self-Sealing Gland Packings are simple in construction, easy to install and adjust. They cost less per foot of hole drilled as both rods and packing last longer.

Install Mission Self-Sealing Gland Packings the next time you change rods. They are sold through supply stores everywhere.

Nothing but the finest will bear the name of MISSION MANUFACTURING CO.

MISSION MANUFACTURING CO. • P. O. Box 4209 • Houston, Texas • Cable Address—"Missco" • Export Office: 30 Rockefeller Plaza, New York
In Great Britain: MISSION MANUFACTURING CO., LTD. • 17 Hanover Square • London, W.1, England • Cable Address—"Missoman"

Slush Pump Valves • Valve Springs • Valve Seat Pullers • Pistons • Piston Rods
Liners • Gland Packings • Slips • Swabs • Centrifugal Pumps • Plug Valves

Weather Forecasters Study the Past Better to Predict the Future

. . . Better "guesses" are on the way, but patience is pleaded

by Archie M. Kahan

METEOROLOGISTS are faced with the necessity of issuing forecasts of weather hours, days or weeks ahead, in spite of a lack of complete understanding of the complex natural laws which govern atmospheric behavior.

For aid in meeting their forecast responsibilities meteorologists have turned to the records of weather events for guidance. Persistence forecasting, use of past weather maps as analogs of future situations, and weather-pattern types are the related concepts which have developed from this study of the past.

Progress in improving forecasts should come with increased understanding of atmospheric dynamics and the ever-increasing availability of high-speed computers, but the using public should expect slow progress rather than revolutionary developments.

Persistence forecasting . . . Webster defines persistence, when applied to physical science, as the : "Continuance of an effect longer than the cause which first produced it." Meteorologists have shaded this meaning of persistence to include the continuation of an effect, the fundamental cause of which is either partially or wholly unknown, and may or may not be continuing.

Recognition of the great importance of persistence in determining the character of day-to-day weather does not always come painlessly to the forecasting meteorologist. An example may serve to illustrate this. The meteorologist faced with the relatively simple problem of forecasting tomorrow's minimum temperature must ask and answer several questions. Included among these are:

1. What air will be affecting the station by tomorrow morning?
2. What is the present thermal structure in that air?
3. How will that thermal structure change as the air moves toward the station?
4. What amount of heat energy will be added to the air by passage over a warmer surface?
5. Will clouds form to limit the amount of radiational cooling? How much cooling should I allow for?

Some objective and some subjective techniques are available for answering these and other required questions, but all too often the forecast goes astray. In his eagerness to consider each factor operating to produce change the forecaster may overforecast the change. When the minimum temperature is observed the next morning it may turn out to be very similar to the previous minimum temperature.

The forecaster then has to acknowledge that a persistence forecast, one in which he merely shaded the status quo, would have been superior to his effort to understand and allow for the causative factors which affect air-temperature change. It is as if the atmosphere is characterized by an inertia to change which results in the continuation of some weather effects in spite of apparently powerful influences tending to produce change.

Factors Affecting Forecasts

Persistence in weather is exhibited in many ways and results from many different factors. Reservoirs of heat energy, such as large bodies of water or the wide expanse of moist soil, serve to moderate what would otherwise be drastic temperature changes at points downwind. Mountain barriers produce persistent cloudiness and contribute persistent interference to air flows which might otherwise change the weather downwind.

Less obvious are the causes of persistent circulation patterns which become established in the atmosphere and produce repetitive sequences of weather events for several days before the pattern finally changes sufficiently to break up the train of similar weather events.

Through experience the forecaster becomes aware of the relative extent to which persistence factors and change factors are apt to affect tomorrow's weather and he uses this knowledge, sometimes subconsciously, in preparing his day-to-day forecasts.

When the forecast assignment passes from prediction of tomorrow's temperature to predicting the mean temperature for next month or for the next 3 months, the forecaster abandons hope of being able to weight the various causative factors which affect temperature behavior. He begins to look for ways to let persistent nature do this for him.

Past techniques . . . One favorite method of the past has been to seek guidance from statistical correlation techniques. For example, by relating the mean temperature in past Junes in Iowa to the mean temperature for the period July through September, Charles D. Reed found a correlation of 0.56. This result indicates some tendency for persistence into the July-September period of the cause or effect of June temperature experience.

To the meteorologist faced with finding tools to use in forecasting the July through September mean temperature for Iowa such a correlation coefficient is encouraging. To the statistician concerned with unexplained variance it is not impressive. The meteorological literature contains several studies of this type for other places and other seasons.

Some of these studies include attempts to employ physical reasoning while others are more or less hopeful applications of statistics without physical basis. Improvement in such persistence techniques is conceivable if a sound physical model of the atmosphere can be used as the basis for stratifying the past data into groups having closer relation between variables used for predicting and those being predicted.

Other frequently used substitutes for physical reasoning are the analog and the typical weather pattern. It is usually easy to find a past weather map that looks strikingly like today's weather map, just as you can find your personal

Author is executive director, Texas A.&M. Research Foundation, College Station, Tex.
Paper presented at annual A.P.I. meeting, Chicago, November 12, 1956, under the original title, "Persistence and Typical Weather Patterns."

double in a large crowd if you are not too much of a stickler for detail.

It is not so easy, however, to find a double whose father looks like your father and whose son resembles your son. So it is with weather maps. The longer the sequence of weather maps to be matched the more difficult it becomes to find a period of such similar weather experience that a one-for-one correspondence exists between past daily weather maps and present or future maps.

Forecasts for 3 to 7 days can sometimes be based on series of analogous weather maps, but as the period lengthens, more and more leniency about detail is needed in selecting the analog. Only very occasionally do sequences with acceptable similarity hold up for a month, and a considerable amount of hindsight may be required to determine this similarity.

Weather Types

As standards of comparison become more lenient, it is possible to classify weather-map sequences into relatively discrete groups called weather types. Six days seem to be about the upper limit to the duration of such sequences and resemblances are frequently more apparent to the person selecting the types than to the unbiased observer.

The theory of use of weather type is that weather events are relatively similar during all examples of a particular type so that as soon as the present situation is typed the future weather for the next 6 days, say, can be specified within broad limits. For forecasts of longer duration it becomes necessary to forecast a type recurrence (persistence), or a type transition. No satisfactory method of doing this has been described in the literature.

One of our meteorological research projects at Texas A. & M. Research Foundation has been seeking to type weather maps by using the number of high-level waves present on a hemispheric weather map. The stimulus for this research came from model experiments known to meteorologists as "dishpan experiments." It is possible to set up in a rotating dishpan waves similar to the waves in the upper atmosphere.

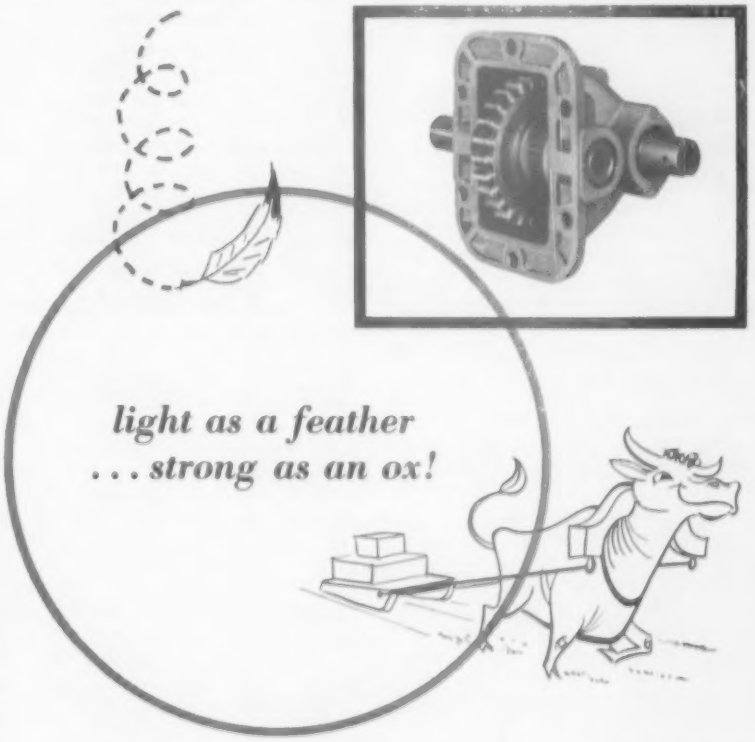
For a given distribution of heat sources and sinks and a given rate of rotation these wave patterns are quite stable (persistent). As the heat distribution or rotation of the pan changes, the wave pattern resists change for a while then changes rapidly to a new stable pattern. It is to be expected that similar behavior would be noted in the atmosphere. Some actual cases studied showed considerable persistence, but additional work needs to be done.

The admittedly crude efforts already made at typing by this system offer prospects of circulation forecasts 4 to 6 days in advance. With additional research to refine the method of specifying the wave number greater utility might result. When we learn to separate inconsequential wiggles from significant waves in an objective way, this typing method may provide further forecast advantages.

Accelerating progress . . . Until recently it was necessary for the meteorologist interested in long-range forecasting research to proceed with his work at a painfully slow pace. Hand plotting, divergent analyses of past maps, sparse data networks, and imperfect understanding of atmospheric dynamics have limited what could be undertaken and accomplished in one man's lifetime.

The increasing availability of electronic data processing and our increasing understanding of atmospheric behavior should combine to accelerate our progress toward anticipating future weather effects.

I believe that progress in long-range forecasting will come gradually, with seemingly "revolutionary discoveries" springing up only to fade away, leaving behind small kernels of additional understanding.



THE *NEW* TULSA® POWER TAKE-OFF

SINGLE SPEED • MEDIUM DUTY

Extremely light . . . you can hold it in the palm of your hand . . . because the NEW TULSA Power Take-Off has a die-cast aluminum housing which at the same time gives all the ruggedness and durability for which the TULSA line is famous around the world. Output shaft available in three sizes—13/16", 7/8" and 15/16"—and rotates on two needle bearings. Furnished with either cable or lever control to suit individual operators' requirements. Designed and built for the full range of medium duty work, this new power take-off offers the extra advantage of low price, nationwide distribution and service that have made the TULSA line a favorite everywhere.

Tulsa Winch
TULSA, OKLAHOMA DIVISION OF VICKERS Inc.

Let's look at what we're doing about

RADIOLOGICAL SAFETY

. . . in the petroleum industry

by B. A. Fries

THREE pertinent questions arise in the discussion of radiological safety in the petroleum industry:

1. What is the relationship between "radiology" and the petroleum industry?

2. What and how serious are the hazards found in this relationship?

3. How is work safely carried out in the presence of these hazards?

● First, the petroleum industry, with the exception of the nuclear industry itself, has led all others in applications of radioactivity and radiation to its technological problems. Radium and uranium were used when only natural radioactivity was known. The development of high energy accelerators and nuclear reactors added a wide variety of artificially produced radioisotopes. These tools have been applied in every phase of petroleum technology.

● Second, the petroleum industry must deal with a new type of safety problem. This radiological problem is more obscure than many other safety problems. None of our five senses can directly perceive radiation. Yet, physiological damage is produced by the interaction between living tissue and large doses of high-energy radiation, such as X-rays and gamma rays or high energy particles, such as electrons, beta rays, and neutrons.

● Third, the principles of radiological protection are well known; therefore, methods are available for coping with these very real hazards. A remarkable record of radiological safety has been achieved in the atomic energy industry, itself. The petroleum industry deals with radioactivity many orders magnitude less than the radioactivity in the atomic energy industry. Our problem is easier. With good safety practices and at reasonable cost, we can continue to employ and expand the uses of radioactivity in the technical progress of our industry.

Author is with California Research Corp., Richmond, Calif. Paper presented at A.P.I. annual meeting, Chicago, November 12, 1956, under the original title, "Radiological Safety in the Petroleum Industry."

Applications

The petroleum industry uses radioisotopes and nuclear radiations extensively in its many activities.[1,2] They play a role in the search for oil, in the refining and transportation of products, and in the research laboratory. Some uses require small amounts of radioactivity with minimal safety requirements; others require large amounts with appropriately increased care.

In oil-field exploration, neutron sources containing up to 100 mc. of radium are used in well logging. In field studies, the movement of gases underground has been traced with tritium and radiokrypton. Underground water movement in water studies has been traced with radioiodine. A number of well-completion operations, such as acidizing, squeeze-cement tracing, and lost-circulation location employ radiotracers.

Refining . . . A large number of refining operations are followed, checked, or controlled by radioactivity methods which require only a few millicuries of tracer. Some of these are:

1. Measurement of circulation rate of catalyst beads in Thermofor catalytic cracking and Houdriflow catalytic cracking plants.
2. Measurement of mixing and losses of catalyst in fluid catalytic cracking plant.
3. Measurement of entrainment in distillation and scrubbing columns.
4. Measurement of mixing and segregation of liquid stocks.
5. Measurement of gas and liquid flow rates.
6. Leak testing.
7. Level gaging of liquids and solids.
8. Pipeline interface marking.

In the research laboratory, radiation sources and radiotracers also find wide use. The chemist uses them to trace the course and to measure the kinetics of chemical reactions. The analyst has learned to use them for rapid and simple chemical analyses. The engineer uses radioactive engine parts to measure wear and deposit formation.

There is currently great excitement in the field of "refining by radiation." Many companies are now studying the effects of nuclear radiations on petroleum materials and products. These studies require great sources of radiation, either kilocuries of radioisotopes or high-energy particle accelerators whose outputs are equivalent to hundreds of kilocuries of radiation.

The Radiation Hazard

There are two distinct types of radiation hazard—the external hazard, in which the whole or part of the body is irradiated by a source outside the body; the internal hazard, in which a radioactive substance enters the body through the mouth, lungs, or skin and produces injury.

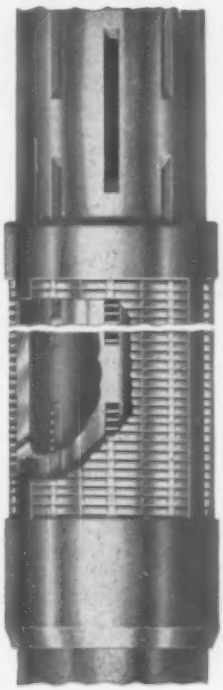
In acute exposures of the whole body to large external doses, the clinical effects are mainly injury to the blood-forming tissues and the intestinal tract. These tissues are very sensitive, but they have considerable recovery power. The median lethal dose LD_{50} in man is 400 to 600 roentgens (r.).

These acute lethal doses are not possible in most industrial applications. The exceptions may be in the irradiation of materials with kilocurie sources or radiation machines. Exposures at relatively low levels over a long period of time may result in delayed effects, such as leukemia, skin cancer, and shortening of the life span.

Life shortening may result from factors other than those caused by damage to specific tissues. These general factors are lowered immunity, damage to connective tissues, or premature aging. Among those working and adhering to present permissible levels, no effects have been detected. This situation should apply to workers in the petroleum industry.

In injury from internal radiation, the organ most likely to be affected is the one in which the radioactive material

EMSCO SLOTTED . . .



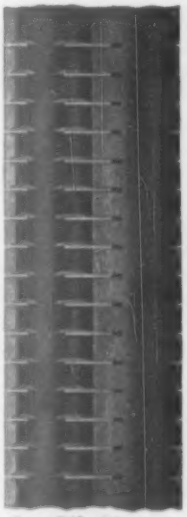
A SUPERIOR SCREEN FURNISHED IN A FULL RANGE OF SLOT GAUGES

With Emsco, the manufacture of slotted screen pipe is serious business. Our shop is equipped with machines designed especially for this purpose . . . machines that produce high quality slotted screen pipe, with slots ranging from .010 to .100 or larger if required.

We're proud of our facilities for producing this full range of slotted pipe. We're proud, also, of the record established by Emsco Slotted Pipe in wells all over the world. It retains 80% to 85% of the original collapse strength of the pipe . . . it may be spudded or rotated reasonably without damage . . . may be easily cut and pulled . . . and its V-shaped slots provide maximum drainage with minimum clogging. It's furnished, of course, in all popular sizes of pipe, to length as specified.

Emsco also manufactures "Vertical Slotted" Wire Wrapped Screen, with slotted openings that stay open longer, provide more drainage area per foot and retain 25% more strength than pipe with drilled holes with equal area.

For full information on Emsco "Slotted" and "Wire Wrapped" Screen Pipe, write for a copy of our latest catalog.

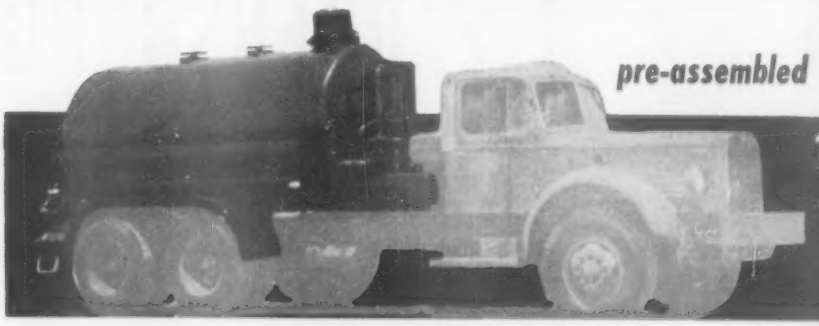


For Oil, Gas or Water Wells

EMSCO SCREEN PIPE COMPANY

2219 BROOKS STREET Phone CA 7-6346 HOUSTON, TEXAS

Export Representative: Val R. Wittich, Inc., 30 Rockefeller Plaza, New York 20, N. Y.



pre-assembled **VACUUM TANK**

Ready to Mount on Your Truck

SELF-CONTAINED MODEL WT is made with capacities of 35, 40, 45, 50 and 55 bbls. Comes complete, ready for work. Has its own gasoline engine, pump and 4-way valve.

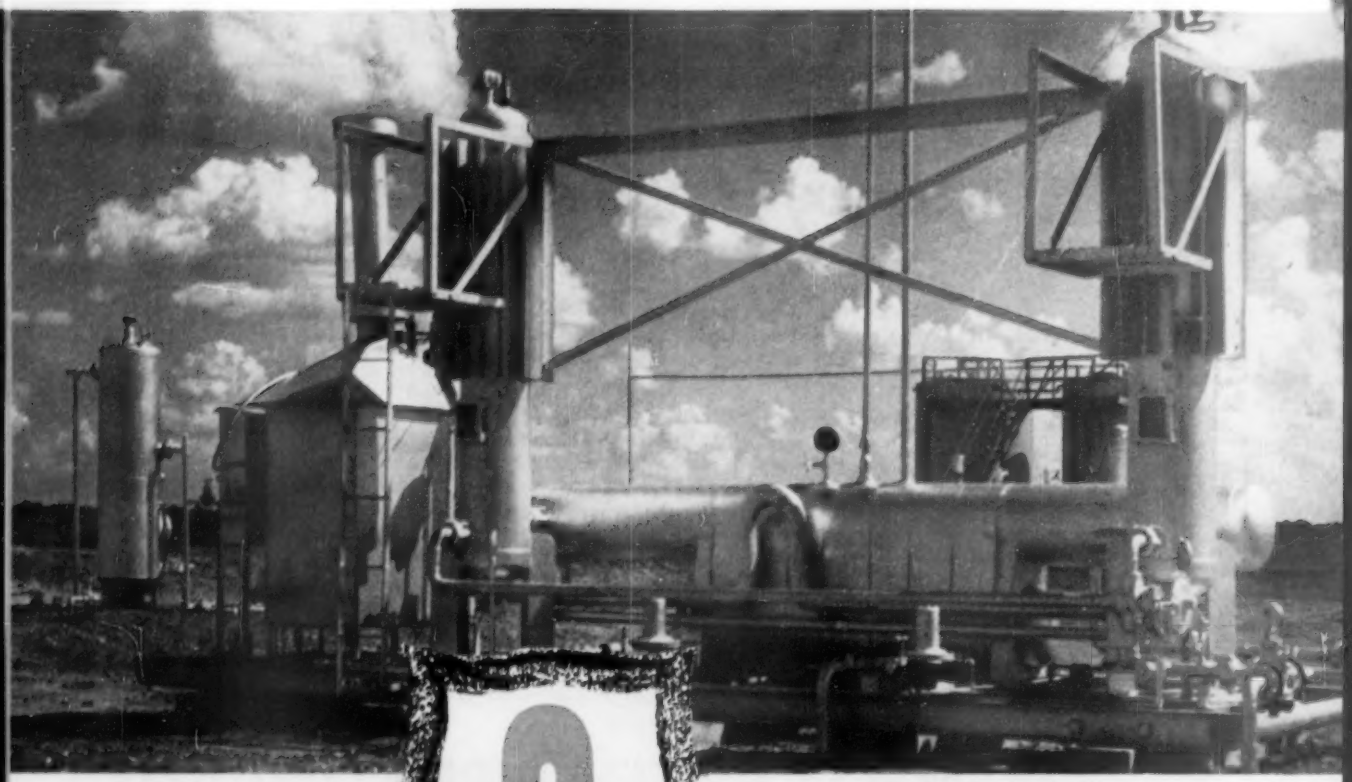
THOMPSON, the originators of the unitized vacuum tank, now makes available this self-contained model WT. It's factory-readied for you to mount on any CA 120" truck in your own shops. Put the WT on your truck in the morning; put it to work after lunch!

WRITE FOR SPECIFICATIONS, complete with blue-printed mounting instructions. If you'd like to see a Thompson Unitized Vacuum Tank at work, we'll tell you where, in your own area, you can watch it save time and money — pay for itself time and time again. Write today.

FOR SUPER-FAST CLEANING OF:

- CRUDE TANKS
- DRAIN BOXES
- RUN-DOWN TANKS
- SEPARATOR BOXES
- CAUSTIC TANKS
- DRAIN LINES
- CATALYST SLURRY
- And a hundred other field, refinery and pipeline chores.

SOLE LICENSEE TO MANUFACTURE VACUUM TANKS UNDER U. S. PATENT No. 2522077



YOU SAVE 3 WAYS WITH A

PARKERSBURG

*DAU WELDRIER

In addition to obtaining the most efficient dehydration in the world today, you realize tremendous savings with the Parkersburg DAU WELDRIER.

Your savings begin with the initial low cost of this compact unit, along with savings on equipment and installation. The DAU requires no auxiliary operating equipment such as heaters, separators, piping, valves and costly hookup time. It is completely unitized, piped, and skid mounted—ready to go on stream with but four connections.

Your savings on operating costs amount to as much as several hundred dollars per month because the DAU requires one third less desiccant—uses 80% less fuel gas.

Your savings from the costly effects of corrosion are inestimable. The DAU removes water vapor at the wellhead to eliminate corrosion and hydrate troubles from the gathering system and the entire pipeline.

These three big savings make the Parkersburg DAU WELDRIER your best dehydrator buy today. Get complete details from your Parkersburg Representative.

* DYNAMIC ADSORPTION UNIT

Parkersburg
RIG AND REEL COMPANY
DIVISION OF PARKERSBURG : AETNA CORPORATION

3345 WINTHROP AVENUE
FORT WORTH 16, TEXAS

5632

"Radiation injury is extremely serious, and effective therapy does not exist."

concentrates most. Strontium, radium, and plutonium are "bone seekers." Iodine concentrates in the thyroid gland.

Hence, radioactive substances vary greatly in toxicity, depending upon biological factors such as absorption, retention, and concentration in specific tissues, and physical factors, such as energy, half-life, and the type of radiation.

Radiation regulations . . . Radiation injury is extremely serious, and effective therapy usually does not exist. Hence, radiation protection is concerned essentially with the prevention of injury. To implement this, a code of conduct has been drawn up which sets conditions for safe work with radioactivity and radiation.

The first efforts at radiation protection were set up by the British Roentgen Society in 1915. In 1928 an International Committee was organized. In 1934 this committee first suggested the "tolerance dose."[3] During the last war, when work with radioactivity became an industry, the Manhattan Project set up exposure limits quite similar to those established in 1934.

By and large, these figures are still retained; and the latest official revision of standards for protection against radiation established by the Atomic Energy Commission in 1955 uses the same dose limits.[4]

Basically, these regulations allow an occupational exposure for external radiation of 0.3 r. in any week, but with exceptions up to 3 r. in any 3-month period. Further restrictions to doses integrated over longer periods extending to the whole working lifetime and to a large segment of the population must be anticipated.

This is so because reproductive germ cells may propagate radiation injuries from generation to generation. A first step in this direction is found in the June 1956 report of the National Academy of Science.[5] They hold that any additional radiation above the natural background is genetically undesirable. They recommend restrictions, such that members of the general public receive no more than 10 r. in addition to background (about 4 r.) from conception to age 30 and that individual persons receive not more than 50 r. to the reproductive cells up to age 30 and not more than an additional 50 r. up to age 40.

Other regulations deal with maximum permissible levels of radioisotopes in air and water for protection of workers and the general public against internal hazards. Table 1, which we post in our laboratories, is an abbreviated form of several AEC regulations.[6]

Protection from External Radiation

With external radiation, we are dealing principally with gamma rays and to only a limited extent with beta rays. There is a considerable variety of radiation monitoring instruments by means of which we determine the radiation level from sources and establish the needs for radiation protection. Geiger counters, scintillation and ion chamber detectors are commonly used.

There are three principles—distance, time, and shielding—which we employ either singly or in combination to effect the required protection. The area survey meters are used to map out fields of radiation to establish safe working times within the fields and to establish shielding needs.

Besides these instruments, there are personnel monitors, such as pocket dosimeters and film badges. These are used to provide direct checks on actual exposures.

Tolerance limits . . . Tolerance limits are set at 300 milliroentgens (mr.) per week. On an 8-hour-day, 5-day-week basis, tolerance is 7.5 mr. per hour. We must stay below this quantity; we prefer it to be as low as possible. Where space and time are not important criteria, distance can be used as the simplest and cheapest form of protection. We take advantages of the radiation square law.

In practice, distance between the operator and the source of radiation may be achieved through use of long-handled tools or in a much more elaborate style by the use of remote-control equipment. Time is another principle which can be used with great flexibility. From measurement of radiation levels, the time necessary for completion of the job can be estimated and the working time so restricted as to remain within the tolerance limits.

When space is at a premium or radiation levels are so high as to limit working time to very short periods, biological shielding becomes necessary. Lead, iron, and concrete are generally used for these shields. Temporary shields may be constructed for specific jobs. Other jobs may require elaborate permanent shields.

Hot laboratory . . . The "hot laboratory" is a facility where all these principles can be used and their uses properly coordinated. Such a laboratory is usually required for tracer work in quantities above a few millicuries. The hot lab is a permanent structure making use of permanent shielding and providing work and storage facilities.

The structure may be simple or complex, depending upon the nature of the work. It may contain very expensive equipment, such as master-slave remote manipulators and special leaded glass windows for viewing.

After work is under way, we must make sure that we remain within our radiation exposure limits. For this, we use our personnel monitors. If we wish to monitor our exposure following a particular operation, we read this directly off a self-reading dosimeter. If we suspect that a particular step in the operation is responsible for the greatest amount of exposure, we can

TABLE 1—MAXIMUM PERMISSIBLE QUANTITIES OF RADIOISOTOPES, MICROCURIES

Isotope—	T.B.T.*	M.P.S.I.†	A.E.Q.‡	Per ml. air	Per ml. H_2O
C-14	250	140	50-50	1.4×10^{-5}	3.6×10^{-4}
Ca-45	65	89	10-10	9×10^{-6}	5×10^{-5}
Ce-144	5	5	1-10	2×10^{-7}	3.6×10^{-6}
Co-60	3	5	1-10	3.4×10^{-7}	1.8×10^{-5}
Cs-134	90	13		3×10^{-6}	1×10^{-4}
Cs-137	90	13	1-10	6×10^{-7}	1.5×10^{-6}
Fe-55	1,000	840	50-50	1.8×10^{-5}	4×10^{-4}
Fe-59	11	10	1-10	5×10^{-7}	1.1×10^{-5}
H-3	10,000	1,300	250-250	7×10^{-3}	1.6×10^{-2}
Kr-85	100	100		3×10^{-7}	1×10^{-5}
Na-22	55	9	10-10	3×10^{-7}	1×10^{-5}
Nb-95	90	15	10-10	1.3×10^{-6}	4×10^{-5}
Ni-63	110	6	1-10	3×10^{-7}	1×10^{-5}
P-32	10	12	10-10	4×10^{-7}	2×10^{-5}
Po-210	0.02	0.07	0.1-1	2×10^{-10}	
Ra-226	0.1			2.4×10^{-11}	4×10^{-7}
S-35	100	140	50-50	3×10^{-6}	5×10^{-4}
Sb-124	28	5	1-10	3×10^{-7}	1×10^{-5}
Se-75	10			3×10^{-7}	1×10^{-5}
Sr-89	2	14	1-10	6×10^{-8}	7×10^{-6}
Sr-90	1	8	0.1-1	6×10^{-10}	8×10^{-8}
Tl-204	180	16	50-50	3×10^{-6}	1×10^{-4}
Zr-95	10			3×10^{-7}	1×10^{-5}

*T.B.T.—Total body tolerance. †M.P.S.I.—Maximum permissible single intake. ‡A.E.Q.—Authorization-exempt quantity, unsealed-sealed.

read the dosimeter immediately before and after this step to find the net exposure. If we believe that there will be an appreciable exposure to the hands, we strap a dosimeter to the wrist as well as wearing one on the body (shirt pocket).

Such immediate control cannot be achieved by the use of film badges. The badge is generally worn for a week at a time, then must be returned for film processing and evaluation. The exposure may not be known for some 2 weeks after it has occurred. Then it may be difficult to recall the circumstances of the exposure.

There are several other disadvantages to the film badge. It is energy dependent; that is, sensitivity varies greatly with energy. Development of the film is critical. The film density depends on the particular developer, temperature, exhaustion through use, time, agitation, fading after development, etc. It is, therefore, necessary to develop control films along with the unknowns.

Our own practice with self-reading dosimeters is to have the individual user record the initial, final, and net readings. He also records the date and signs his name for these data, which are then kept as permanent company records. A high reading can readily be spotted by the supervisor and corrective measures taken. A few dosimeters will serve a large number of workers, while those who work with radioactivity frequently are provided with their own instrument.

Protection from Internal Radiation

Radiation "asepsis" is the condition for protection from the internal hazard. Spread of contamination on surfaces and in the air must be avoided. To avoid the absorption of minute amounts of beta and alpha-emitting isotopes, the worker may wear rubber gloves, a breathing mask, and carry out the work in a fume hood.

An alternate method is to carry out the work completely within an enclosed container. This is commonly called a "glove box." Here the radioactivity is totally confined at all times. All the operations are carried out within the box through glove ports. When necessary, shielded boxes may be used.

The amount and specific nature of the radioactivity determine the extent of the precautions. For example, working with carbon-14 is not particularly hazardous. The total body tolerance, which is the maximum amount that may be permanently fixed in the body, is 250 microcuries for carbon-14.

Work with strontium-90 is extremely hazardous. For this isotope, the total body tolerance is only 1 microcurie. Our laboratory safety reminders, shown

TABLE 2—RADIATION AND RADIOACTIVITY LABORATORY SAFETY REMINDERS

Where ionizing radiation exceeds 7.5 mr. per hour:

1. Wear radiation dosimeter and record exposure.
2. Maximum allowable exposure is 300 mr. per week.
3. Report any case of overexposure to the radiological safety officer.
4. Monitor shipping containers and storage vault when materials are received or transferred.

Where radioactive materials are present in unsealed containers:

(a) In quantity above maximum permissible single intake.
(b) In specific activity above 10 mc. per gram, and
(c) In concentration above 10 mc. per kilogram.

5. Do not smoke, eat, or drink in this room.
6. Post warning sign where materials are used.
7. Monitor air while working with materials which may give rise to dust, spray, or vapor.
8. Check hands and tools for contamination constantly when working with unsealed materials.
9. Clean up promptly any contamination above 1 mr. per hour on skin, clothing, benches, or floor and report to radiological safety officer.
10. Label and store in vault materials not in use.

JOB WANTED

Night and day watchman. Always alert, never sleeps. Will watch over your engines at all times, let you know immediately when lubricating oil pressure drops too low or cooling water overheats. Then you can correct the trouble before it becomes critical. Will warn you in one of three ways—sound an alarm, flash a warning light or shut down the engine. Finest references: have proven record of success on thousands of engines. Will guard your engines just as faithfully. My name: Penn engine safety control. No salary required—just a few dollars at the very beginning will cover everything.

And, I will perform my duties equally well with your present engines or with new equipment direct from the manufacturer. Get my complete story from your jobber.

PENN CONTROLS, INC. Goshen, Indiana

AUTOMATIC CONTROLS FOR HEATING, REFRIGERATION, AIR CONDITIONING, GAS APPLIANCES, PUMPS, AIR COMPRESSORS, ENGINES

in Table 2, point out a number of precautions that we follow to avoid internal contamination.

Waste Disposal

The disposal of radioactive waste is one of the more perplexing aspects of work with radioactivity. On the scale of use in the petroleum industry, the disposal problem is not difficult. Proper planning can simplify the problem no matter what method of waste disposal we choose.

Wastes may be disposed of by burial in the ground, burial in the ocean, or disposal in public sewers. Burial in the soil requires many special conditions. The area must be devoid of edible plant life, the activity must not leach from the soil, and the area must be marked and protected against unauthorized entry.

Ocean burial is quite simple. Collected wastes are reduced in volume as much as possible; for example, by evaporation of excess liquid. The bottle or cartons of waste material are placed in steel barrels and covered with wet concrete mix so that the final bulk density of the barrel will insure sinking in the ocean.

In our practice, we limit the radiation level of the outside surface of the barrel to 200 mr. per hour of gamma rays to also satisfy ICC shipping regulations. The barrels are dropped in the ocean where the water is at least 1,000 fathoms deep.

Disposal into public sewers requires that the material be water soluble and that certain concentration limits be adhered to. These are: 100 mc. per million gallons of sewage for isotopes with a half-life less than 30 days and 10 mc. per million gallons for half-lives greater than 30 days.

Some isotopes are more severely restricted. These dilutions refer to volumes of sewage in which the dilution is expected to occur. Dilutions of this order of magnitude are easy to reach but should be verified by calculation.

Radiation safety training . . . Responsibility for designing and safely conducting radioactive experiments belongs to a qualified expert on radioactivity. The task of carrying these tests, particularly routine ones, ultimately involves other technical and nontechnical personnel. These personnel must be trained on the job.

In our practice, an expert discusses with these personnel the nature of the radiation problem and demonstrates the equipment employed for radiation protection. He supervises and participates in one or more of these tests with them until he is assured that they are reliably using safe practices.

Radiation surveys of work areas are made periodically or whenever some new activity is carried out. Personnel exposure records are also examined. In this way, all radioactivity work is continually reviewed.

Examples of Safety Practice

Most tracer experiments in petroleum technology are carried out with quantities from a few millicuries up to 1 curie. Very few require more than 10 mc. Laboratory tracer experiments usually require only a few microcuries. Irradiation of materials requires multicurie cobalt-60 sources or high energy accelerators.

There is no particular safety problem in laboratory tracer research because the quantity rarely exceeds a few microcuries. Here the problem is to avoid contamination which can spoil the experimental results. The use of powerful gamma ray and electron sources for irradiation purposes requires shielding and remote handling equipment. These facilities are generally incorporated as part of a hot laboratory.

The typical radioactive application in the refinery is a technical service test. These tests may require several millicuries in the field, although preparation of the tracer for the test may in-

7133 HC

corrosion sits on your board!

He's there alright. Maybe you've felt his profit-busting hand on the company finances as of now . . . maybe not until tomorrow.

Electrolytic corrosion is a malignant destroyer of buried or submerged metallic structures and pipelines. Unlike the dreaded human malady, IT CAN BE CURED. That's our business. We are "doctors" for metals . . . specialists who can prevent or cure electrolytic corrosion quickly . . . economically.

It is a fact . . . in many instances, the cost of a HARCO cathodic protection system can be reclaimed within a few months . . . through savings in normal maintenance and replacement costs.

. . . unless you have Harco cathodic protection

HARCO supplies a complete range of services. Whatever your needs . . . job engineered systems, contract installations or cathodic protection materials . . . look to HARCO . . . first in the field of cathodic protection.

Harco

Write today for catalog or call MOntrose 2-2080.

CATHODIC PROTECTION DIVISION

THE HARCO CORPORATION

16961 Broadway • Cleveland, Ohio

volve processing 100 mc. or more in the hot laboratory.

Tested equipment should be used, and small or partial shields should be installed when needed. A dry run, that is, practice without tracer, usually exposes weak points in the procedure so that safe techniques may be applied in the real test.

Tracing fluid catalysts . . . These studies were carried out to measure catalyst deactivation and mixing rates in the fluid cracking units. In mixing studies carried out by Shell Oil Co.[7] the catalyst was tagged with up to 2 mc. of scandium-46 and cerium-144. The hot catalyst was then mixed with about 850 tons of ordinary catalyst in the plant unit.

Counting was done with the highly sensitive scintillation detector. The labeled catalyst was prepared in the research laboratory and was shipped to the refinery. It was added to the cracking unit by a trained radiochemist so that refinery operating personnel were not exposed. Radiation levels during the injection operation ranged from a few milliroentgens per hour to a few hundred milliroentgens per hour in these tests. But the time required was only a few minutes so that actual exposures were quite small.

Shielding and long-handled tools were not needed. Once the radioactive catalyst was uniformly mixed with the total inventory, the external radiation level was negligible, about 0.01 mr. per hour which is roughly equal to the background level. For internal contamination by ingestion or inhalation, one would have to maintain steadily in his body several tons of catalyst to even reach the body tolerance level.

In catalyst deactivation studies, where about 50 mc. of tracer was used and stack losses were much greater, it was still necessary to ingest from 5 to 15 lb. of catalyst to reach body tolerance. The stack effluent concentrations were still below continuous breathing levels.

A similar study was carried out by The Texas Co.[8] where the fluid catalyst was labeled with about 50 mc. of cobalt-60. These investigators monitored the air in the vicinity of the stack for radioactivity with AEC air samplers. Although 1 mc. of cobalt-60 left the stack during the first day, only traces could be detected in the samplers.

Mixing in crude stills . . . An unusual batch of crude oil was to be refined through a battery of crude stills.[9] The refinery operators wished to segregate the tar from this crude as completely as possible from the tar ordinarily produced. By adding a tracer at the moment this special crude was run, the appearance of the tracer peak in the tar bottoms would indicate the logical moment for switching the special tar to a separate tank.

For this test, 10 mc. of cobalt-60 was used. The cobalt-60, diluted in a pint of thinner, was injected from a simple pressure vessel. The radiation level about 6 in. from the vessel at the valve location was about 400 mr. per hour. Since the operation took only about 1 minute to complete, the exposure to the hands was only about 7 mr., well below tolerance exposure for the hands.

The maximum concentration of radioactivity found in the tar bottoms was five counts per second, which was only about half the background rate. The total activity was ultimately passed out the stills in a volume of 3,000 bbl.

Pipeline interface marking . . . For more than 6 years, a tracer method has been in use for marking interfaces between product shipments in the Salt Lake-Pasco Pipe Line.[10] Each time the Salt Lake pump station changes the product being pumped through the line, a few milliliters of tracer liquid containing about 2 mc. of antimony-124 is injected into the line between the products.

AN-SPEC

COMPREHENSIVE SURVEYING

Highest

- QUALITY MATERIALS
- EXPERIENCED ENGINEERING
- CONSTRUCTION KNOW-HOW

Comprehensive surveying is just one of several services so important to the final results you will obtain from cathodic protection. Pipe Line Anode Corporation offers every service needed for scientific protection against costly corrosion. AN-SPEC magnesium anodes are guaranteed for high purity. It takes top quality product and specialized, complete service for best results. Call us today.

PIPE LINE ANODE CORPORATION

P. O. BOX 996 • TULSA, OKLAHOMA

2230 Magnolia Street, Birmingham, Alabama
11525 East Colfax, Denver (Aurora), Colorado
858 Wilson Avenue, Newark, New Jersey
912 West 11th, Houston, Texas

Distributor: Crose-Curran, Ltd., Edmonton, Alberta—Phone 3-5135

What are the radiation safety problems in this operation? First, the tracer liquid must be prepared. For this, a few rundred millicuries of radioactive material is processed in the hot laboratory at Richmond, Calif., by trained technicians. The pipeline tracer is shipped to Salt Lake suitably packaged to satisfy ICC shipping regulations for radioactive materials.

At Salt Lake, the tracer is transferred to a shielded storage container from which it is dispersed in 2-mc. portions to mark the interfaces. All of these manipulations are carried out well within tolerances.

Once in the pipeline, the radioactive material is so diluted that it can be detected only with highly sensitive instruments. The radiation dose at the surface of the pipe whenever a tracer wave goes by amounts to only 0.02 mr. Since the operation is done only once a day, this exposure is far below the 60-mr. per day limit to anyone standing along the pipe.

The activity in products is extremely low. In our practice, the mixed products in the interface zone are discarded into slop tanks. This takes with it the bulk of the tracer. When the interface is between gasoline cuts, the tracer is diluted into tankage volume of the order of 10,000 bbl.

At this concentration, one must drink 25 bbl. of gasoline at once to reach the maximum permissible single intake. Accumulation of radioactivity in automobile engines has been investigated.

Grease mixing . . . The efficiency of several grease-mixing vessels was evaluated at the Baltimore refinery at Esso Standard Oil Co.[11] An oil-soluble radioisotope was added to the top of each vessel. As the tracer was mixed, the count rate on a scintillation detector outside the vessel gradually approached a constant value. At this point mixing was complete.

Safe disposal of radioactivity from the commercial grease was accomplished in this test by using a short-lived isotope, iodine-132, which has a half-life of only 2.3 hours. This isotope is the daughter of 77-hour tellurium-132. The radioiodine can be separated every few hours from the parent. In this way, a supply of iodine-132 could be kept on hand for a week or more.

References

1. B. A. Fries, D. E. Hull, and S. B. Jones, "Applications of Radioactivity in Petroleum Technology," World Petroleum Congr., Proc. 4th Congr., Sect. V (C) 329, Rome, June (1955); The Oil and Gas Journal, 54 (75) 268, Oct. 8 (1956).

2. D. E. Hull and B. A. Fries, Proc. Intern. Conf., Peaceful Uses of Atomic Energy, 15, 199, Geneva (1955).

3. G. J. Hine and G. L. Brownell, Radiation Dosimetry, Academic Press, New York, N. Y. (1956).

4. Atomic Energy Commission, "Notice of Proposed Rules for Standards for Protection Against Radiation," Federal Register, 20, 510, Government Printing Office, Washington, D. C., July 16 (1955).

5. Committee on Genetic Effects of Atomic Radiation, National Academy of Sciences: summary report, Science, 123 (3209), Washington, D. C., June 29 (1956).

6. "Maximum Permissible Amounts of Radioisotope in the Human Body and Maximum Permissible Concentrations in Air and Water," Natl. Bur. Standards (U. S.) Handbook No. 25 (1953).

K. Z. Morgan and M. R. Ford, Nucleonics, 12 (6) 32 (1954). Atomic Energy Commission, "Licensing of Byproduct Material," Federal Register, 21, 213, Government Printing Office, Washington, D. C., Jan. 11 (1956).

Also Reference 4.

7. V. P. Guinn, Nucleonics, 14 (5) 69 (1956).

E. Singer, D. B. Todd, and V. P. Guinn, "Mixing Patterns in Commercial Catalytic Cracking Units," Preprints, General Papers, 1 (1) 5, Division of Petroleum Chemistry, American Chemical Society, Dallas, Tex., Apr. 8-13 (1956).

8. A. J. Kinsella, Jr., and J. J. Mitchell, "Better Catalytic Loss Studies," Petroleum Processing, 10 (11) 1718 (1955).

9. D. E. Hull, B. A. Fries, J. G. Tewksbury, and G. H. Keirns, Nucleonics, 14 (5) 51 (1956).

10. D. E. Hull and B. A. Fries, "Radioactive Control of Products Pipeline Operation," The Oil and Gas Journal, 52 (9) 66, July 6 (1953).

11. George Weber, "Radioisotopes Help Solve Refinery Problems," The Oil and Gas Journal, 54 (69) 99, Aug. 27 (1956).

Serving the Pacific Northwest is General Petroleum Corporation's new refinery near Ferndale, Washington. The 35,000 barrel-a-day Mobilgas refinery is served with crude oil by a pipeline from Canada and by tankers from throughout the world.

Partners in Petroleum

. . . to serve the expanding Pacific Northwest

Dependable, quality controlled chemicals assure greater refinery efficiency, increased production and aid in reducing costs. Numerous refineries throughout the United States and Canada are long-time users of PENNSALT quality controlled chemicals.

ANHYDROUS AMMONIA
•
ANHYDROUS HYDROFLUORIC ACID
•
CAUSTIC SODA
•
LIQUID CHLORINE

PENNSYLVANIA SALT MANUFACTURING COMPANY OF WASHINGTON

Tacoma, Washington

OFFICES AND TELEPHONES

Tacoma, MArket 9101
Los Angeles, LUdlow 7-6244
Berkeley, AShberry 3-2537
Portland, CApitol 8-7655
Philadelphia, LOcust 4-4700
Vancouver, B. C., PAcific 7578

Pennsalt Chemicals

1850-1956

Will There Be Enough Casing and Tubing for Tomorrow's Drilling?

Outlook is that present and planned steel mill output should supply the oil industry's needs until 1960. But mills continue to control the production pattern and there is no fixed capacity of oil-country tubular goods. The industry should make a concerted effort to sell its demands for future needs.

by H. W. Ladd

DURING most of the time since 1946, development and production operations have been handicapped and curtailed in various degrees by our inability to obtain enough tubular materials from normal sources of supply. These are the steel-pipe mills of domestic manufacturing concerns. They are specifically designed and equipped to produce highly specialized oil-country tubular goods as their principal product plus line pipe and other pipe.

Fundamentally, the condition has been the result of a dynamic and unprecedented expansion of our national economy which has created, in nearly every market, a demand greater than supply. Here is the cause of our troubles—lack of steel and of adequate oil-country tubular-goods production to meet the rapidly increasing requirements of the petroleum industry.

Oil forecast . . . Economists, analysts, and other competent authorities are constantly studying the ever-increasing growth of petroleum demand and supply to make rational projections of the future and for the guidance of businesses interested in or connected with the petroleum industry. Without exception, later forecasts predict increases over earlier estimates of future demand and supply for at least the next decade. A peak of domestic production is forecast for 1966-75.

One report shows for the past 23 years domestic consumption of oil has approximated a 5.8 per cent annual growth, compounded. Even though this trend was temporarily interrupted by recessions, depressions, and wars, growth was resumed at the same rate thereafter. This trend is predicted to continue for at least the next 10 years. Tables 1 and 2, illustrating the growth rate of domestic demand and supply, have been selected from available forecast data.

Wells needed . . . The continued increase in demand for petroleum products and natural gas will call for a maximum effort to maintain the high-level relationship between domestic production and reserves which now exists. An ever-increasing number of wells will be necessary to find and produce the required volumes, as is shown in Table 3. The estimates given are based on the rates of annual increases established as the trend since 1945, viz., 4.3 per cent for number of wells and 7.0 per cent for footage drilled.

The increases forecast for the next decade may appear amazing and even incredible, but are no more amazing than the actual growth during the past decade. Past forecasts have consistently fallen short of actual accomplishments—and many of those forecasts were considered fantastic.

Steel demand . . . The steel industry in particular has been subjected to a tremendous impact by the rapidly increasing national demand for all of its products. In this advance of steel production, our position has not been too satisfactory. The tubular-goods mills collectively have not always received the steel needed for maximum production required to meet petroleum-industry needs.

The oil and gas industry is reported to receive directly from steel mills and mill distributors only about 7 per cent of the total steel produced in this country. This percentage does not include

TABLE 1—DOMESTIC DEMAND TREND

Year	Petroleum (thousand bbl. per day)	Gas (billion cu. ft. per day)
1946	4,900	11.0
1950	6,500	17.3
1955	8,400	25.8
1956 (est.)	8,900	27.1
1960 (est.)	10,400	35.3
1965 (est.)	12,500	43.0

TABLE 2—DOMESTIC SUPPLY TREND

Year	Petroleum (thousand bbl. per day)	Gas (billion cu. ft. per day)
1946	5,067	11.0
1950	5,906	17.3
1955	7,532	25.8
1956 (est.)	7,855	27.1
1960 (est.)	9,150	33.7
1965 (est.)	10,200	38.9

TABLE 3—TOTAL WELLS DRILLED IN THE UNITED STATES

Year	Number	Average depth, ft.	Footage drilled (thousand of feet)
1946	29,229	3,321	97,070
1950	43,279	3,680	159,267
1955	56,682	3,974	226,270
1956 (est.)	59,100	4,096	242,109
1960 (est.)	69,800	4,546	317,356
1965 (est.)	84,200	5,212	438,850

Author is chairman, A.P.I. central committee on standardization of oil-field equipment. He is with Stanolind Oil & Gas Co., Tulsa. Paper presented at thirty-sixth annual A.P.I. meeting, Chicago, under the original title, "Will the Supply of Casing and Tubing Be Adequate for Tomorrow's Drilling?"

steel required for the manufacture of machinery, equipment, containers, and other materials used by us. Of this 7 per cent about 3 per cent is oil-country tubular goods, perhaps a surprisingly low figure. Where do oil-country goods stand in the over-all pipe and tube manufacturing picture? Here is the 1955 production record:

1955 PRODUCTION RECORD

	Tons	Per cent
1. Line pipe	3,083,736	31
2. Standard pipe	2,968,241	30
3. Oil-country tubular goods	2,542,109	26
4. Mechanical tubing	965,829	10
5. Pressure tubing	276,068	3
Total	9,835,983	100

It is estimated that the oil and gas industries together use about two-thirds of the total pipe and tube production, even though only a small percentage of the standard pipe, mechanical tubing, and pressure tubing tonnage is used by those industries.

Mill capacities . . . Between 1946 and 1953, the mills did little to increase their production capacity for oil-country goods, but did increase tremendously their capacity for electric-welded line pipe. The unprecedented demand for line pipe, and particularly for large-diameter transmission line pipe, undoubtedly had a considerable adverse effect on oil-country goods production. This was partially responsible for the fact that steel for such production was often not available.

Here was a period of complex and rapidly changing conditions. In the early portion of this decade, steel was short at normal prices. This produced a black or gray-market situation. A short recession followed; then came the impact of the Korean situation, climaxed by the complications caused by a general steel strike.

Since 1953, the production capacity for oil-country goods has been increased about 58 per cent, and currently approximates 2,900,000 tons annually. This increase has resulted principally from the construction of two new seamless mills and two new electric-weld mills with a total annual capacity of some 600,000 tons. During this same period, the existing mills did much to revise their production patterns to more closely meet the demand for casing and tubing in Grade N-80 and higher, and for a greater proportionate production of oil-well tubing. A large quantity of special manufacturing and heat-treating equipment was required to make these changes.

Each year in the past 10 (except 1949) has seen an increase in oil-country tubular-goods production by domestic mills in spite of many difficult conditions and interruptions which often included shortages of steel. The total increase for the period was 60 per cent. Even so, rate of production has generally been inadequate to meet the more rapidly increasing demand for oil-country tubular products.

Plugging the gap . . . In their efforts to offset this shortage from regular mills, some operators have been forced to resort to abnormal sources of supply, paying high premiums in most cases; and sometimes accepting material of undesirable quality. Material purchased from these abnormal sources of supply have included:

. . . **Premium-priced raw steel** converted into pipe or tubes by oil-country or other pipe-and-tube mills, and finished by the converting mill or outside source as casing or tubing. (This can be done only when mill space is available as the result of shortage of regular-price steel for normal production, as in 1947, 1948, and 1949.)

. . . **Plain-end pipe** or tubes from any available source, domestic or foreign, finished by outside sources as casing or tubing.

. . . **Foreign** oil-country tubular goods.

. . . **Line pipe** and standard pipe, for use as casing or tubing when conditions permit.

. . . **Used** casing, tubing, and drill pipe.

Availability of material from any of these sources varies greatly according to conditions. Only a relatively small amount of conversion casing and tubing has been manufactured during the past few years because of lack of available steel and/or mill space. The purchase of plain-end tubes for finishing continues to be the most important supplemental source for critically short oil-well tubing. The addition of oil-well tubing capacity, recently installed or contemplated by several mills, will reduce the necessity for such purchases accordingly.

Expansion of the petroleum industry in foreign fields has reduced the availability of oil-country goods manufactured abroad for import to the United States. It is estimated that about 65,000 tons of foreign casing and tubing will be imported during 1956 for use in the United States. It is improbable that a greater tonnage will be available to us in the future, in spite of the fact that three new foreign mills will soon be completed.

The physical properties of line pipe and standard pipe limit their use as casing or tubing to wells having shallow depths and low pressures. Such pipe also is in short supply.

The used material available for purchase is a small but consistent source of supply. Most salvaged pipe is retained for use by the original owner.

Casing and tubing available for domestic use from all these abnormal sources is expected to total about 200,000 tons in 1956. The amount of casing and tubing salvaged by operators for their own use should provide another 200,000 tons. The exported quantity of total mill production, estimated at 125,000 tons, must be deducted. Net tonnage available from sources outside the regular mills will therefore total 275,000 tons, or 11 per cent of the anticipated total yearly requirements. It does not seem probable that this quantity will increase in the future to any great extent—another 100,000 tons would be the maximum expectancy.

What mills can do . . . Many different manufacturing arrangements of mill equipment exist among concerns which produce tubular goods. A particular mill or mills within the same company may produce oil-country goods only or line pipe only. Many make all types of pipe at the same mill or mills.

Inside the total mill capacity-production relationship lies the capability and desirability of meeting user demand for the various types of products. It is obvious that the quantity and item distribution should be controlled to best fit the individual manufacturing picture. The tonnage set up for the manufacture of oil-country goods must be divided further to meet the producing conditions. Although the circumstances vary greatly among these manufacturing concerns, the over-all distribution pattern for the year (shown following) will give you a close estimate as to how the oil-country business splits up.

DISTRIBUTION PATTERN

	Per cent	
Casing	77.0	(29 per cent in Grade N-80 and higher)
Tubing	18.6	(16 per cent in Grade N-80 and higher)
Drill pipe	4.4	(76 per cent in Grade E and higher)
Total	100.0	(26 per cent in all high grades)

Voluntary allocation . . . When demand exceeds supply, the sellers control. This condition has existed for some time with oil-country goods and has resulted in a system of distribution by the mills which has been described as voluntary allocation. Any system of allocation in the face of a shortage contains in-

equities by its very nature, and this is no exception.

Here are the usual mechanics of ordering, subject to change in accordance with conditions.

For oil-country tubular goods to be delivered during any given quarter, the mills open their order books for the placement of business during the first part of the preceding quarter. Tubular goods are then allocated on the basis of tonnage and of items which can be ordered to make up that tonnage. Following is an example:

TYPICAL TUBULAR-GOODS ALLOCATION

Allocation (tons)	Size (in.)	
300	5½	Maximum 50 per cent in 14-lb.; maximum 25 per cent Grade N-80.
400	7	Maximum 50 per cent in 20-lb.; 20 per cent Grade N-80; 10 per cent Grade P-110.
300	7⅝ and over	Maximum 30 per cent Grade N-80.
90	2⅜ tubing	Maximum 20 per cent Grade N-80.
110	2⅜ tubing	Maximum 20 per cent Grade N-80.
1,200		
100	4½	Grade E drill pipe.

This item distribution is based on a maximum mill-production pattern, and may not suit the operator's well requirements. Some flexibility is permitted in ordering, but the orders must still conform to the mill pattern.

These allotments may be made by the mill to the operator, who will then place his orders direct with the mill or through representative supply stores. Separate allotments may go direct to the supply store. They will make allocation to and receive orders from the operator, or the supply store may order for delivery into its stocks for later sale.

This is difficult to follow because of the several different situations. It will perhaps simplify this explanation to say that direct mill allocations are usually made to those operators, both majors and independents, who regularly drill many wells per year; whereas the supply-store allotments generally must provide for the needs of operators who drill but few wells.

In some cases in which the mill is represented solely by its own supply store, there are no direct mill allocations. One mill has no supply-store representation and therefore handles all orders direct. The point here is that the mill or the supply store presumably to its own best advantage, selects its customers and tells them how much and what they can have.

Few operators have consistently been able to secure allotments from domestic mills for all the oil-country tubular goods they wanted; so the great majority of operators, large and small, have not been able to meet all their needs through this source of supply.

Inventories . . . Much has been said about excessive inventories being maintained by some operators. I doubt if there are many inventories which comprise an adequate and balanced supply for more than 90 days' requirements. Operators with a consistent drilling program have found it desirable (but difficult) to maintain such a quarterly supply as is considered necessary to properly protect their operations.

Drilling usually does not start until pipe is actually available. When ordering 90 to 180 days in advance of normal delivery, such stocks are not unreasonable and should be maintained when possible.

Make our needs felt . . . Before proceeding with the investments of equipment which would raise their production to a predetermined proportion of future demands, it seems certain that steel mills and pipe mills gave careful consideration to all factors to confirm the existence of a long-range market potential in an increasing volume. It obviously took several years for them to be convinced that the position of the production division of the petroleum industry is rapidly developing national economy and its relationship to the national defense was basic and sound. And that it would continue to play an important part in its progression, thereby providing a dependable and ever-increasing demand for oil-country tubular goods for many years.

It is conceivable that a more direct and concerted effort on our part to sell our demands for oil-country goods as most desirable business for the steel industry would have developed a higher priority on steel to produce such products. This effort would more quickly have shown the crying need for a higher rate of oil-country tubular goods production in over-all mill capacity. Possibilities of maintaining closer relationships in the future and doing whatever is consistent and necessary to keep our needs high on the desirable list should be considered.

Oil-country mills have recently made adjustments and increases which put us in better condition potentially or capacitywise than we have been in for a long time—one which approximates current demand. It also is apparent that much improvement in mill production patterns has been made, from which more high-strength material such as Grades N-80 and P-110 will be available; and the ever-existing and heretofore constantly increasing oil-well tubing shortage may be alleviated or eliminated.

Future capacity . . . The steel companies are committed to a schedule of 15 million tons new capacity in the next 3 years. Thereafter, new capacity will increase at the rate of 3½ million tons per year until 1965. Further increase in pipe-mill capacity will be made in 1957 and 1958 as one large and complete pipe-mill unit will go into operation. Several stretch mills and at least two electric-weld mills will produce tubing and small-diameter casing.

Existing capacities for oil-country goods will also be expanded. There are several large-pipe mill units to be added to the picture later if suitable financial arrangements can be made; and it is assumed that these units will be built (see Table 4). Other mills have been contemplated and would be built if assurance of a long-term steel supply could be obtained.

There is no fixed capacity of oil-country goods production by mills, as the schedules are varied to obtain the best possible results in over-all production. The maximum production possible, of course, is the total finishing capacities for oil-country items. The mills will not set figures for their oil-country goods capacities and therefore any estimate made can only assume the proportion of total capacity that can be reasonably expected, with past experience as the principal supporting factor. Using the meager information available the estimated mill capacities are shown in Table 4.

TABLE 4—ESTIMATED MILL CAPACITIES FOR OIL-COUNTRY TUBULAR GOODS

Year	Tons
1956	2,900,000
1957	3,150,000
1958	3,500,000
1959	3,700,000
1960	4,200,000
1965	*5,660,000

*Additional increase in capacity not contemplated at present.

Future demand . . . In forecasting casing and tubing demand, 11.4 tons per thousand feet drilled is used for 1956 through 1959, 11.5 tons for 1960, and 11.6 tons for 1965. This is based on the original rates, established by National Petroleum Council committee reports, projected on the established rate of increase. No sound basis by which it can be increased further can be seen. It should not be lower than these estimates, in any event.

Table 5 gives the relationship of cas-

ing and tubing to shipments, and shows the maximum situation to be expected under the conditions anticipated in the steel and petroleum industries. It assumes no interruptions or adverse circumstances beyond the shortage caused by this year's strike.

TABLE 5—CASING AND TUBING, TONS (MAXIMUM)

Year	Possible demand	Shipments for domestic use
1956	2,760,000	2,250,000
1957	2,953,000	2,835,000
1958	3,160,000	3,150,000
1959	3,381,000	3,330,000
1960	3,650,000	3,780,000
1965	5,091,000	*5,100,000

*Depends upon further increase in capacity.

Should be satisfied . . . If all the new mills are built and present oil-country goods capacities are expanded according to plans, and if the steel is available as expected, we should be able to secure most of the material required to continue under the rate of increase in drilling established by past experience, through the year 1960 at least. After that time a greater increase in mill capacity would be required if the drilling trend continues at the same rate. The steel mills and the pipe mills will continue to control the situation.

If demand for oil-country goods is not met and the required number of wells cannot be drilled in this country, the gap between total domestic petroleum production and total domestic demand for petroleum will widen; and the time necessary to reach the peak of domestic petroleum and gas production will be lengthened.

It is probable that shortage conditions will continue to be critical through 1957, as the petroleum industry will be trying to restore the losses in stocks and drilling footage caused by the steel strike of 1956.

Patrol for pipelines . . .

That's what your Journal Pipeline editors do to keep you posted on engineering and operating ideas, and on who's building what, where.

Don't overlook Pipeline Patrol . . . a regular feature in each issue of the Journal. On alternate weeks, you'll find . . .

- Practical, on-the-job ideas in engineering and operations
- Construction planned or under way in the United States and abroad.

To keep up-to-date with what other Pipeliners are doing, keep up to date with The Oil and Gas Journal's Pipeline Patrol.

ONE OF THE GARLOCK 2,000

SERVICE REPORTS ON THIS PACKING EVEN SURPRISED US!

Typical Service Reports on Lattice Braid Asbestos Packing with Teflon:

- Outlasted another Garlock Style 10 to 1 against blending waxes and steam for cleaning.
- Outlasted competitor's packing 38 to 1 against caustic at 325°F., 50 psi.
- Outlasted other packings 3 to 1 against cold water.

Don't take our word for the greater strength, longer life of LATTICE BRAID with Teflon—try an initial order of 10 or more feet today. The Teflon core and impregnation resist everything except molten alkali metals and some freons.

And, remember, LATTICE BRAID with Teflon is only one of the Garlock 2,000 . . . two thousand different styles of packings, gaskets, and seals to meet every conceivable need. It's the *only* complete line available. It's one reason why you can expect unbiased recommendations from your Garlock representative. Call him, or write for booklet 131.

THE GARLOCK PACKING COMPANY,
Palmyra, New York

For Prompt Service, contact one of the 30 sales offices and warehouses throughout the U.S. and Canada.

GARLOCK

Packings, Gaskets, Oil Seals, Mechanical Seals, Rubber Expansion Joints

When Engineers Double as Buyers

. . . and serve as inspectors and expediters

Buying for the oil industry is rapidly becoming more technical and buyers need the technical services of the engineer. Engineers have an important place in inspecting and expediting equipment, in evaluating sources of supply and in servicing field complaints. Dollars can be saved when engineering side of purchasing is recognized.

by John W. Parks

THE engineer receives valuable technical and business experience in the buying group, experience which can assist him in achieving management positions.

During inspection and expediting in suppliers' plants, an engineer must necessarily negotiate with the supplier in many ways. Cost responsibility must be established for unanticipated conditions. More detailed inspection methods are frequently required when fabricating difficulties must be appraised to devise corrective steps. This is costly to the supplier, and an agreement must be reached on whether the customer or the supplier should rightfully bear the expense. Such negotiation, of course, is closely related to buying.

Oil-business buying is rapidly becoming more technical. Deeper wells, wider variations in processing temperatures and pressures, extremes of all kinds in petrochemical plants, etc., bring up varied technical problems. With these expanded activities, the purchase and stores department must grow in stature to properly evaluate problems and situations as they arise, so that these personnel will handle those questions and problems which are truly a part of purchasing, inspection, or expediting and will not bother technical groups with routine matters. Here is how our engineers function in this regard.

New way to do it? . . . Our experience in processing indicated that a need existed for stainless-steel castings which were different from any commercial specification. Our purchase and stores department engineers visited foundries and discussed the practical applications of the specification with the proper officials. They found it necessary to divert the thinking of the foundry men from normal channels which had resulted after long years of service to a select group of customers.

Some foundries serving the lumber industry, for example, had not done much research on long-time temperature effects; and it was necessary to convince them that proprietary alloys, of which they were very proud, would not be suitable for higher temperature services. Some may have doubted our willingness to pay the price for the special features involved. But, several sources made valuable suggestions.

All comments and suggestions were organized and presented to a committee. An agreement was reached on a revised version of the proposal. We again canvassed the sources.

Two years later — after four such cycles—we issued a good commercial specification which has been in use for 8 years now without a revision. After an operating department has written a requisition for what it wants, the buying group must find sources which can be depended upon to produce the material in a specified quality and on time.

Is supply adequate? . . . For common repetitive items, inspectors' recommendations and the usual business considerations suffice to rate the sources. Current performance records maintain up-to-date evaluations. For unusual or critical fabrication jobs, the purchase and stores department engineer reviews the requirements with the design or process engineers, and then visits the likely sources.

If a review of the plant facilities confirms our engineer's opinion concerning the adequacy of the supplier's facilities, the engineer explains the proposed job to the supplier's officials in order to appraise their staff and also appraise their willingness to tackle the assignment.

The engineer then prepares a written recommendation which is discussed in a meeting with the buyer and the process or design engineer. A final decision is reached at this meeting.

How about quality and delivery? . . . The purchasing department also determines the steps that must be taken to assure quality and delivery. On routine jobs the chief inspector of a geographical division, guided by broad, formal departmental procedures, decides on and executes the steps necessary to inspect and assure delivery as required.

Specific monetary limits are not set on any given order, but the chief inspector is generally made accountable for the holding of expenses within reasonable bounds. Cost studies are made periodically to determine his costs on individual jobs of various types as well as for whole projects. Special jobs necessitate preplanning of inspection and delivery effort before bids can be invited.

The supplier then bids with complete knowledge of the extreme quality control measures which will be applied and/or the importance of delivery and the expediting which will be applied to assure it.

The purchase and stores department engineers lend their assistance throughout these negotiations and meet with the buyer and supplier to negotiate the final details of the contract or order. For example, when the first few orders for the special stainless-steel castings were placed, our engineers and the buyer met with the manufacturer's representative and explained to him what he was expected to do in regard to inspection, testing, etc., and also explained what would be our inspection actions. The order was then accepted by the foundry with complete understanding of the requirements.

What can be screened? . . . Purchasing department personnel must use good judgment in order to avoid attempts to do work which would involve engineering aspects but would actually be beyond their scope. Yet the purchase and stores department staff must do all that they possibly can to relieve engineering groups from procurement problems.

An engineer inspecting some cast-steel pumps was also expediting. When he inspected the castings, he noticed the foundry had been generous and had used a little nickel in the chemistry.

Author is with Standard Oil Co. of California, San Francisco. Paper presented at Chicago A.P.I. meeting, November 13, 1956, under the original title, "The Place of the Engineer in Purchasing, Inspection and Expediting."

The inspector thought it was a good feature, noted its use in his next current progress report and attached the certified analysis to the report.

The metallurgical service group to the process engineers immediately rejected the castings because they realized that nickel, which would enter the stream by corrosion, was poison to the particular process. The inspector should have questioned the analysis when it was established that it was different from the ordered analysis. However, his general knowledge of metallurgy had lead him to believe that he was accepting a superior steel.

The strong delivery aspect, no doubt, was a contributing factor in this failure because it made the inspector possibly overanxious to move things along. As it was, the pump cases were almost completely machined before work was stopped. Such special cases are now brought out in requisitions when it is necessary to caution suppliers against their good intentions and to flag them for buyers and inspectors.

The Purchasing Engineer

The core of our engineers' work presently is in inspection and expediting. Purchase orders requiring these actions are turned over to the inspection group where they are processed to completion. Any change in the order found necessary during inspection or expediting is referred to the buyer for negotiation and formal change order.

In the line organization, materials-engineering service of all kinds is rendered incidentally. Yet, the staff supervisor of inspection, expediting, and quality control spends only about 10 to 15 per cent of his time on routine matters and devotes the remainder to general service.

Forming standards . . . The wider areas where engineers may serve in the purchase and stores department offer many opportunities. Engineers can contribute much by helping purchasing department groups in their contribution to standardization, specifications, and recommended practices.

The engineer quickly grasps the technical purposes and application of operating departments' proposals. With his engineering ability and his wide purchasing experience in many different types of production and fabricating plants, the engineer is able to correlate practical aspects of procurement, trade relations, etc., with the technical goals in preparing standards, specifications, etc.

Our engineers in the purchase and stores department serve on company-wide committees established for this purpose. After assisting in preparing drafts, they secure comments and suggestions of probable sources. These sources are screened so that final issues of standards and specifications are assured of good practical application.

Handling complaints . . . The proper processing of field complaints on defective material and equipment is another field for our engineers. If routine handling does not get results promptly, the buyer refers the matter to the chief inspector in his particular office. This engineer secures the technical facts, then visits the source and explains the difficulties.

Most often, delays are due to misunderstanding. When an engineer explains the field troubles to a shop production man, there is usually no further difference of opinion and a plan is worked out to preclude recurrence of field trouble. Examples of trouble might be improper threading of flanges, surface finish in machine work, revision of design to reduce failures from stresses at notches, etc.

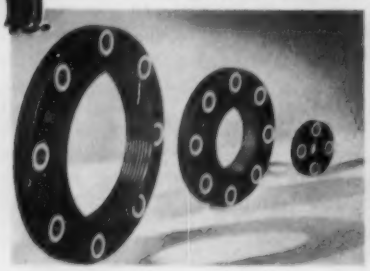
Organization . . . The engineer may be trained for many positions in a purchasing organization, particularly when he begins in purchasing immediately after graduation. A graduate going

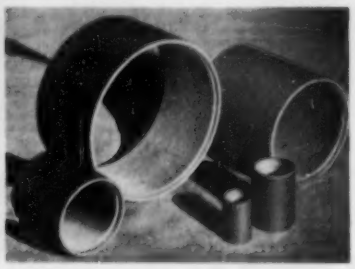
WHEN IT COMES TO SERVICE
COME TO REILLY
Producing Coal Tar Enamels to meet Reilly and customer standards is the job George Jackson has. Coal Tar Enamels manufactured at the Reilly Lone Star plant, as at all Reilly plants, are uniformly excellent, giving the same "feel" of high quality — shipment after shipment.
COLORADO
KANSAS
MISSOURI
OKLAHOMA
ARKANSAS
NEW MEXICO
TEXAS
LONE STAR PLANT
LOUISIANA
As Assistant Manager and Plant Superintendent of Lone Star, Ralph R. Nicholas' job is quality control of production and expediting of customer requirements. His mission is to provide the enamel coating products with quality that will arm them to fight against corrosion wherever they encounter it.
Reilly COAL TAR PRODUCTS
Reilly Tar & Chemical Corporation
MERCHANTS BANK BUILDING, INDIANAPOLIS 4, INDIANA
Sales Offices in Principal Cities
P. O. Box 370, Granite City, Illinois
P. O. Box 247, Lone Star, Morris County, Texas

Minimize

the maintenance factor with

HARRISBURG PIPE FLANGES and COUPLINGS





There are no higher quality standards in industry than those that govern the material, design and manufacturing of Harrisburg Pipe Flanges and Couplings. Are such high standards necessary? Users of Harrisburg products are convinced that they are because maintenance is a vitally important factor today with labor costs at an all-time high.

Harrisburg Drop-Forged Pipe Flanges are made to A.S.A. Specifications in threaded, butt welding, slip-on welding, Van Stone and blind types. Accurately controlled analysis, machining, and inspection assure uniformity that is important to oil field, utility and industrial users.

Harrisburg Seamless Steel Pipe Couplings are made to A.P.I. and A.I.S.I. Specifications and threaded by a special process, developed by our engineers, which produces threads of unsurpassed accuracy in form, height, angle and lead. Threads are electro-galvanized to prevent seizing.

Write for literature and prices.

More than a century in Harrisburg

Harrisburg Steel Co. { DIVISION OF HARSCO CORPORATION } HARRISBURG 6, PENNSYLVANIA

Our complete and modern facilities assure sound design, reliable manufacturing, and prompt, efficient service to every customer.

LOW PRESSURE TREATING UNIT WITH HIGH VOLUME WATER KNOCKOUT

Solves the problems of large water volume and B.S. content on water flooding projects. Complete range of sizes stocked for immediate delivery. Pictured: 6′ x 24′ Type H-E Treater and 4′ x 26′ Water Knockout.

MFD BY M&V TANK COMPANY WICHITA FALLS, TEXAS

TANKS — TREATERS — SEPARATORS

Steel Fabrication for the Oil Industry

directly into purchasing, however, will lack the broad experience necessary for the range of advice and counsel which we anticipate here.

For this reason, starting in 1943, our company moved the outside inspection force bodily from the engineering department to the purchase and stores department, and in 1946 fitted them into our staff-line organization. The chief inspector was made supervisor of inspection, expediting, and quality control on the department manager's staff. He was made responsible for over-all procedures, expenditures, and advice and counsel to the line groups. A chief inspector was established in each of the two geographical divisions, each having four inspectors under him. Each member of the group had some years of refinery or field-engineering, inspection, and operating experience.

A system was also established to make use of commercial inspection agencies in outlying areas and to provide men for peak requirements in work load. The buying groups are similarly organized in staff and line so that our individual engineers work beside and on the same organizational level with the individual staff and line buyers with whom they cooperate.

Training . . . While we prefer technical college graduates, we have found that a man who has only 2 years of college often develops into an excellent inspector. Two years of college provides sufficient background in mathematics, chemistry, and physics for learning much of the work and establishes some habits of logical thinking and studying. However, prospects for ultimate advancement probably are not as great as they would be for a man with a college degree.

It is best to start new men as refinery or oil-field equipment inspectors, or equivalents, to provide them with practical background before sending them into the suppliers' plants. The new men are provided with a set of inspection instructions supplemented by more detailed treatises on various subjects, such as welding, castings, nondestructive testing, steel fabrication, gaging practices, etc. Each man is assisted in learning these subjects thoroughly. They also are assisted in a reasonable manner to go on with their formal education if they desire it.

A system also is used to inform each engineer when lessons are learned by experience or when good or unfortunate results are obtained by others. Furthermore, daily work is programmed with continually increasing responsibility to absorb.

As opportunities arise, the engineers are given experience in buying. We attempt to give each engineer a well-

"The engineer need not be lost in the purchase and stores department. The work develops characteristics necessary for management positions. It presents a variety of problems daily."

rounded experience. We avoid specialization because we have found individual preferences and abilities provide sufficient variety in the direction of specialization.

In addition, we attempt to broaden and refresh the experience of each inspector by temporary transfer during our infrequent periods of low work load. They can be loaned to refinery-equipment inspection groups, to construction-materials handling, to the engineering department, etc.

We have within our company a correlated plan for the exchange of personnel for such purposes. This involves the trading of men who are of approximately equal caliber for an appreciable period—6 months to 2 years. In this way it is possible for us to give shop experiences to a design engineer by using him as an inspector, while our inspector may replace a refinery-equipment inspector who, in turn, replaces the design engineer.

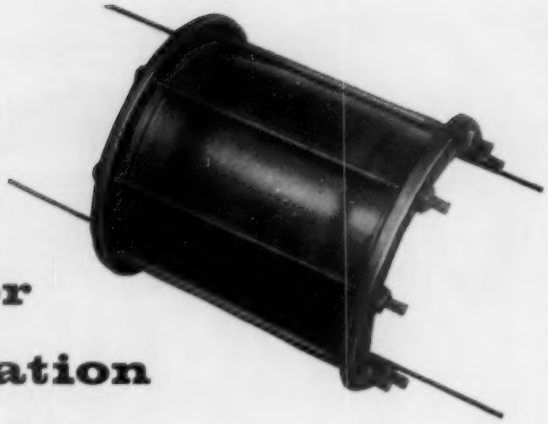
Getting ahead . . . In order to go on to higher positions or to move into actual buying or analytical work in a purchasing organization, the engineer must become more agile in his approach to problems. His formal education teaches him to be coldly logical—a logic based on physical facts and technical assumptions.

Purchasing puts him into much closer contact with people and it requires that he work more with intangibles, such as logic, tolerance, give - and - take, and human relations. These become his tools—equal to or possibly more important than his engineering tools.

Future plans include trainee buyers with engineering degrees. These men may or may not serve temporarily with the inspection group. No emphasis is placed on any specific degree. We have civil, chemical, electrical, mechanical, and metallurgical engineers. Engineers with a master's degree in business administration have advanced rapidly in our group. Young men who changed their college major to business administration after 2 years of engineering also have done well.

Why engineers? . . . We have found it quite logical in practice to have engineers as inspectors and expediters under the administration of purchasing management for the following reasons:

FLINT
STEEL
The completely integrated facilities and personnel of Flint's two conveniently located steel plants enables Flint to provide personalized services of engineering, estimating, detailing and fabricating.
Flint invites your inquiries and requests for consultation. For information contact either plant.
FABRICATED GALVANIZED STEEL
FABRICATED STRUCTURAL STEEL
FABRICATED STEEL PLATE
FABRICATED REINFORCING STEEL
STEEL WAREHOUSE DISTRIBUTORS
CRSI
AISC
for over 40 years
FLINT STEEL CORPORATION
TULSA . . . MEMPHIS



for

faster

installation

join pipe

THE DRESSER WAY!

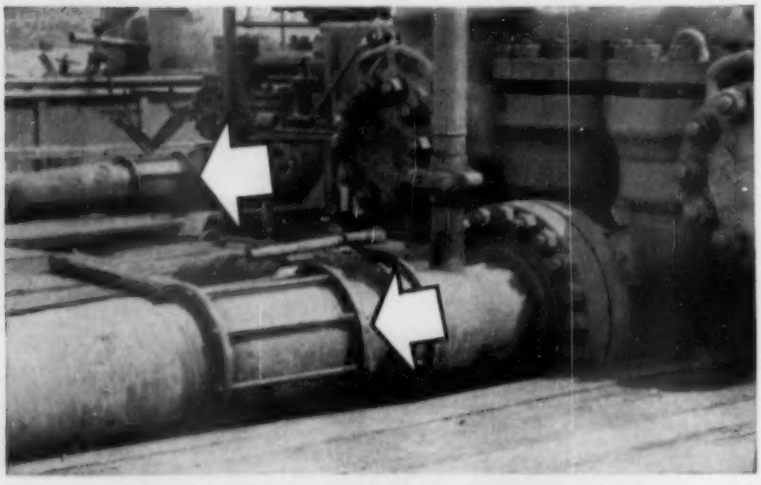
You'll find plenty of uses for Dresser Couplings and Long Sleeves around a drilling rig . . . or anywhere else you join pipe.

That's because Dresser Long Sleeves make pipe joining so quick and easy. Pipe threading is eliminated. You simply slip on the sleeve and tighten with a wrench. Perfect alignment of pipe sections is unnecessary because the specially compounded rubber gasket permits up to 4° deflection at joints.

You get a permanent, bottle-tight connection every time—one that has the "give and take" necessary to absorb vibration, settlement and other stresses.

DRESSER®

Dresser Manufacturing Division • Bradford, Pa.



AVAILABLE AT ALL LEADING OILFIELD SUPPLY STORES IN THE UNITED STATES AND CANADA

Style 38 Coupling

Style 40 Long Sleeve

Hydrapair® Asbestos Cement Pipe Clamp

Style 63 Expansion Joint

Style 39 Insulating Coupling

1. Obviously, engineers generally have the aptitudes and the training necessary to understand when material and equipment must be inspected and to be of real help in recognizing and solving delivery problems while expediting. They also provide the technical ability necessary to evaluate sources where quality is paramount in the choice of bidders.

2. Inspection and expediting are inseparable from buying because, in a legal sense, inspection and expediting are functions necessary in certain more complex purchases in order to reach agreement currently on terms and to see that the terms are met.

3. Inspectors and expediters deal almost continually with suppliers and contractors, which is a function of purchasing. Their combined experience and engineering education is of great assistance in guiding the buyer and the process engineers through the necessary steps for the procurement of highly technical equipment.

4. There is no clash with the engineering department or with operating groups so long as engineers of experience are employed—engineers who understand and operate within proper limits of authority and, when necessary, seek cooperation from the engineers for whom the equipment is being purchased.

5. Engineers as inspectors and expediters who have gained experience in purchasing not only see and understand things in the shops that buyers must know, but also can express themselves in concise terms which are of technical assistance to the engineering department and operating engineers.

The engineer need not be lost in the purchase and stores department. The work develops characteristics necessary for management positions. It presents a variety of problems daily; it offers numerous opportunities to influence and guide others. Inspection and expediting require broadening experiences, such as travel, working with many people at all levels of business, and working alone away from home ties.

These experiences are particularly good for an engineer because he must learn to quickly appraise complex situations in unfamiliar surroundings, analyze a maze of detail, and bring order out of chaos. He must be decisive while practicing compromise.

Inspection and expediting and related materials-engineering consulting service in the purchase and stores department are fields in which to exercise individual initiative and growth and to influence developments. All of these are good and satisfying for the individual and are, therefore, profitable for the company because they develop habits and attitudes that are necessary in supervisory positions.

Now available . . . Streamlined model forms for

Unit Agreements, and Unit Operating Agreements

by H. F. Beardmore

UNIT Agreement and Unit Operating Agreement model forms for use in connection with the unitization of oil and gas fields now are available to the petroleum industry.

Use of these model forms will simplify and shorten the negotiating period in the formation of a unit. And they will facilitate the handling by parties assigned to the processing of the agreement.

The use of model forms in other phases of oil and gas operations always has been most beneficial. There are model reporting forms and model accounting-procedure forms, to mention only two of the many available for use.

Oil and gas fields are unitized principally for conservation purposes. The formation of a unit permits production on a pool-wide basis and facilitates cycling, pressure maintenance, and water flooding by eliminating the problems caused by separate tracts and leases. There are now in excess of 300 pool-wide, or nearly pool-wide units. Approximately 30 units are being organized yearly, and the trend is increasing.

Negotiations required . . . Many of the agreements now in effect relating to unit operations were consummated after a long period of negotiation. This delay has been costly to the parties at interest because of the postponement of the unit operation, and because the processing of the various preliminary drafts of the agreement necessitated the attention of highly trained persons of varied skills.

Experience has shown that a negotiating group, starting with a model form, can consummate an agreement many months earlier than when starting from "scratch" because of the utilization of standard provisions which constitute the major portion of the agreement.

The A.P.I. Subcommittee on Unit Agreements (Appendix 1) was formed following the 1954 annual meeting of the Institute. The committee was composed of operating personnel and attorneys experienced with the subject. Membership was selected to provide representation from all producing areas of the United States, as well as from the large companies, the small companies, and those with the viewpoint of individuals and royalty owners.

Author is with Warren Petroleum Corp., Houston. Paper presented at A.P.I. annual meeting, Chicago, November 14, 1956, under the original title, "The A.P.I. Model Form of Unit Agreement and Unit Operating Agreement."

Three types . . . The committee determined that forms used for unitization fall into three basic types.

- One type covers an agreement for the joint operation of a single lease or of a few leases.
- The second covers the unitization of many leases on a pool-wide basis prior to drilling.
- The third is for unitization on a pool-wide basis where development is complete or substantially complete.

Progress had been made toward developing model forms for the first two types (Appendix 2) but no approach had been made on the third type, which the committee believed required the greatest amount of detailed negotiating.

There is frequent use of the third type, and there is considerable need for any contribution that would reduce the problems normally arising from this type of unitization. The committee, therefore, directed its attention to the agreement form for pool-wide unitization, where development is complete or substantially complete.

Two model forms, resulting from the committee's work, now are available from the A.P.I. office in Dallas. One is titled "Unit Agreement," and covers the phases that are necessary for public record together with the agreement articles which usually must be signed by the royalty owners. The second form, which supplements the first, is titled "Unit Operating Agreement." It is solely for the working-interest owners and sets out the basis upon which the unit is to be operated.

The table of contents for each of these agreement forms is included herein (Exhibits A and B), to illustrate the topics covered in each form. The order of listing has been given detailed attention by the committee.

Standard provisions . . . The agreement forms contain about 80 per cent standard provisions developed from a background of many years of preparing unit agreements in all parts of the country. This portion can be adapted to new units with none or, at most, minor modification. The remaining items have reasonable similarity in use and, although suggested language is carried in the model form, it is recognized that modification will be required because of the variety of applications to which the forms may be subjected.

A basis of participation in the unit has not been included. This is fundamentally a negotiating item for each unit, and varies because of many factors normally involved. A discussion of the methods of determining participation in unit agreements was covered by an A.P.I. paper by E. B. Miller, Jr., published in Drilling and Production Practice (1953), and *(The Oil and Gas Journal, May 25, 1953, page 184).*

Certain situations could not be covered on a nation-wide basis. Federal-land states have special regulations, and minor modification of the form will be required by the user. Some oil fields have unusual conditions which cannot be anticipated in a form. No provision has been made for "controlled acreage" which, in certain areas, is referred to as "nonparticipating acreage." These situations must be handled according to the circumstances.

The items included in the forms are those deemed necessary for a complete agreement. A serious effort was made to reduce the length of the agreement, but this was found most difficult in view of the inclusion of many provisions considered essential by past usage. It is expected that the model forms can be improved after a period of use, and the committee will appreciate constructive suggestions which may develop from experience with such forms.

APPENDIX 1

Membership of Committee

("O" indicates operating personnel; "L" indicates legal personnel.)

Harry D. Aggers (O), Union Oil Co. of California, Los Angeles.

H. F. Beardmore (O), Warren Petroleum Corp., Houston.
R. M. Churchwell (O), Ohio Oil Co., Findlay, Ohio.
John Cook (O), Carter Oil Co., Denver.
J. F. Diver (L), Ohio Oil Co., Terre Haute, Ind.
V. S. Donoghue (L), Vinson, Elkins, Weems & Searls, Houston.
Dick H. Gregg (L), Humble Oil & Refining Co., Houston.
George Jenkinson (O), Stanolind Oil & Gas Co., Tulsa.
Jack Jones (L), Stanolind Oil & Gas Co., Tulsa.
D. G. Kingman (O), General Petroleum Corp., Los Angeles.
Rene Lavenant (L), General Petroleum Corp., Los Angeles.
P. H. O'Bannon (O), Humble Oil & Refining Co., Houston.
E. K. Parks (O), Consultant, Los Angeles.
Dick Ryan (O), Carter Oil Co., Billings, Mont.
Jack Tarner (O), Phillips Petroleum Co., Bartlesville, Okla.
R. M. Williams (L), Phillips Petroleum Co., Bartlesville, Okla.
F. F. Wright (O), Sinclair Oil & Gas Co., Tulsa.

APPENDIX 2

Rocky Mountain Unit Operating Agreement, Rocky Mountain Oil and Gas Association, Denver.

Model Form Operating Agreement, Oklahoma Model Form Committee — Operating Agreement, 1411 Classen Boulevard, Oklahoma City.

EXHIBIT A

TENTATIVE A.P.I. MODEL FORM

UNIT AGREEMENT

TABLE OF CONTENTS

Section

Preliminary Recitals

ARTICLE 1
DEFINITIONS

1.1 Unit Area
1.2 Unitized Formation
1.3 Unitized Substances
1.4 Working Interest Owner
1.5 Royalty Owner
1.6 Tract
1.7 Unit Operating Agreement
1.8 Unit Operator
1.9 Tract Participation
1.10 Unit Participation
1.11 Outside Substances
1.12 Oil and Gas Rights

ARTICLE 2
EXHIBITS

2.1 Exhibits
2.1.1 Exhibit A: Tracts and Tract Participtation
2.1.2 Exhibit B: Plat of Unit Area
2.2 Reference to Exhibits
2.3 Exhibits Considered Correct
2.4 Correcting Errors
2.5 Filing Revised Exhibits

ARTICLE 3
CREATION AND EFFECT OF UNIT

3.1 Oil and Gas Rights Unitized
3.2 Personal Property Excepted
3.3 Amendment of Leases
3.4 Continuation of Leases and Term Royalties
3.5 Titles Unaffected by Unitization
3.6 Injection Rights

ARTICLE 4
PLAN OF OPERATIONS

4.1 Unit Operator
4.2 Lien of Unit Operator
4.3 Operating Methods
4.4 Change of Operating Methods

ARTICLE 5
PARTICIPATION

5.1 Tract Participation
5.2 Relative Tract Participations

ARTICLE 6
ALLOCATION OF UNITIZED SUBSTANCES

6.1 Allocation of Tracts
6.2 Distribution Within Tracts
6.3 Taking Unitized Substances in Kind
6.4 Failure to Take in Kind
6.5 Responsibility for Royalty Settlements
6.6 Royalty on Outside Substances

ARTICLE 7
USE OR LOSS OF UNITIZED SUBSTANCES

7.1 Unitized Substances Utilized
7.2 Unitized Substances Lost

ARTICLE 8
TRACTS TO BE INCLUDED IN UNIT

Section
8.1 Percentages of Commitment Required
8.2 Subsequent Commitment of Interest to Unit
8.3 Revision of Exhibits

ARTICLE 9
TITLES

9.1 Warranty and Indemnity
9.2 Removal of Tract from Unit Area
9.3 Revision of Exhibits
9.4 Working Interest Titles
9.5 Royalty Owner Titles
9.6 Payment of Ad Valorem Taxes to Avoid Title Failure
9.7 Production Where Title in Dispute

ARTICLE 10
EASEMENTS OR USE OF SURFACE

Section
10.1 Grant of Easements
10.2 Use of Water
10.3 Surface Damages

ARTICLE 11
ENLARGEMENTS OF UNIT AREA

11.1 Enlargements of Unit Area

ARTICLE 12
TRANSFER OF INTEREST

12.1 Agreement Is a Covenant
12.2 Effect of Transfers
12.3 Waiver of Rights to Partition

ARTICLE 13
RELATIONSHIP OF PARTIES

13.1 No Partnership
13.2 No Sharing of Market
13.3 Royalty Owners Free of Costs
13.4 Information to Royalty Owners

ARTICLE 14
LAWS AND REGULATIONS

14.1 Laws and Regulations

ARTICLE 15
FORCE MAJEURE

15.1 Force Majeure

ARTICLE 16
EFFECTIVE DATE

16.1 Effective Date
16.2 Certificate of Effectiveness

ARTICLE 17
TERM

17.1 Term
17.2 Termination by Working Interest Owners
17.3 Effect of Termination
17.4 Salvaging Equipment Upon Termination

ARTICLE 18
COUNTERPART

18.1 Separate Counterparts or Ratifications
18.2 Joinder in Dual Capacity

EXHIBIT B

TENTATIVE A.P.I. MODEL FORM

UNIT OPERATING AGREEMENT

TABLE OF CONTENTS

Section

Preliminary Recitals

ARTICLE 1
CONFIRMATION OF UNIT AGREEMENT

1.1 Confirmation of Unit Agreement

ARTICLE 2
EXHIBITS

2.1 Exhibits
- 2.1.1 Exhibits A and B: Reference to Unit Agreement
- 2.1.2 Exhibit C: Unit Participation
- 2.1.3 Exhibit D: Accounting Procedure
- 2.1.4 Exhibit E: Insurance Provisions

2.2 Revision of Exhibits

ARTICLE 3
SUPERVISION OF OPERATIONS BY WORKING INTEREST OWNERS

3.1 Over-all Supervision
3.2 Particular Powers and Duties
- 3.2.1 Method of Operation
- 3.2.2 Drilling of Wells
- 3.2.3 Well Workovers and Change of Status
- 3.2.4 Expenditures
- 3.2.5 Disposition of Surplus Facilities
- 3.2.6 Appearance Before a Court or Regulatory Body
- 3.2.7 Audits
- 3.2.8 Inventories
- 3.2.9 Technical Services
- 3.2.10 Assignments to Committees
- 3.2.11 Removal of Unit Operator
- 3.2.12 Enlargement of the Unit Area
- 3.2.13 Adjustment of Investments
- 3.2.14 Termination

ARTICLE 4
MANNER OF EXERCISING SUPERVISION

4.1 Designation of Representatives
4.2 Meetings
4.3 Voting Procedure
- 4.3.1 Voting Interest
- 4.3.2 Vote Required Generally
- 4.3.3 Vote Required Large Expenditure and Special Items
- 4.3.4 Vote at Meeting by Nonattending Working Interest Owners
- 4.3.5 Poll Votes

ARTICLE 5
INDIVIDUAL RIGHTS AND PRIVILEGES OF WORKING INTEREST OWNERS

5.1 Reservation of Rights
5.2 Specific Rights
- 5.2.1 Access to Unit Area
- 5.2.2 Reports by Request

ARTICLE 6
UNIT OPERATOR

6.1 Initial Unit Operator
6.2 Resignation or Removal
6.3 Selection of Successor

ARTICLE 7
POWERS AND DUTIES OF UNIT OPERATOR

7.1 Exclusive Right to Operate Unit
7.2 Workmanlike Conduct
7.3 Liens and Encumbrances
7.4 Employes
7.5 Records
7.6 Reports to Working Interest Owners
7.7 Reports to Governmental Authorities
7.8 Engineering and Geological Information
7.9 Expenditures Less than $.....
7.10 Settlements Less than $.....

ARTICLE 8
TAXES

8.1 Ad Valorem Taxes
8.2 Direct Taxes and Assessments

ARTICLE 9
INSURANCE

9.1 Insurance

ARTICLE 10
CONFORMANCE OF INVESTMENTS

10.1 Personal Property Taken Over
10.2 Inventory and Evaluation of Personal Property
10.3 Personal Property Conformed to Unit Participation
10.4 Investment Adjustment
10.5 General Facilities

ARTICLE 11
DEVELOPMENT AND OPERATING COSTS

11.1 Basis of Charge to Working Interest Owner
11.2 Budgets
11.3 Advance Billings
11.4 Commingling of Funds
11.5 Lien of Unit Operator
11.6 Wells Drilled by Unit Operator
11.7 Excess Royalty Burden

ARTICLE 12
OIL IN LEASE TANKAGE ON EFFECTIVE DATE

12.1 Gage of Merchantable Oil

ARTICLE 13
OPERATION OF NONUNITIZED FORMATIONS

13.1 Right to Operate in Nonunitized Formations

ARTICLE 14
FAILURE OF TITLE

14.1 Warranty and Indemnity

ARTICLE 15
LIABILITY, CLAIMS AND SUITS

15.1 Individual Liability
15.2 Settlements

ARTICLE 16
INTERNAL REVENUE PROVISION

16.1 Internal Revenue Provision

ARTICLE 17
NOTICES

17.1 Notices

ARTICLE 18
WITHDRAWAL OF WORKING INTEREST OWNER

18.1 Withdrawal

ARTICLE 19
ABANDONMENT OF WELLS

19.1 Rights of Former Owner
19.2 Plugging

ARTICLE 20
EFFECTIVE DATE AND TERM

20.1 Effective Date
20.2 Term

ARTICLE 21
ABANDONMENT OF OPERATIONS

20.1 Termination
- 20.1.1 Oil and Gas Rights
- 20.1.2 Right to Operate
- 20.1.3 Salvaging Wells
- 20.1.4 Cost of Salvaging

ARTICLE 22
COUNTERPART EXECUTION

22.1 Execution by Separate Counterparts or Ratifications

ARTICLE 23
SUCCESSORS AND ASSIGNS

23.1 Successors and Assigns

Texas' Oil Formations—How They "Figure"

by Frank E. McGonagill, Jr.

THE booklet entitled "Oil Production History of the Southwest," prepared by the oil and gas department of the Bank of the Southwest, presents statistical information on important oil-producing formations in seven southwestern states. Its basic data were obtained from "Statistics of Oil and Gas Development and Production," Vol. 9, published by the American Institute of Mining and Metallurgical Engineers—Petroleum Branch. Additional data were obtained from Yearbook 1955 of the National Oil Scouts and Landmen's Association.

The Texas section of the booklet contains data on 27 formations in 8 oil-producing areas. It covers a total of 2,025 fields with a cumulative production through 1954 of 9,489,691,827 bbl. At the end of 1954, average cumulative field production for the formations presented was 4,686,268 bbl.; average cumulative recovery per acre was 1,693 bbl., with an average cumulative acre-foot recovery of 116 bbl.

The 1954 total production from these fields was 551,052,720 bbl. or approximately 58 per cent of the total state production for that year. During the same period, the average field production was 272,147 bbl.

The earliest production in Texas from formations covered in this summary was established in Gas Ridge field of Bexar County, which has been producing from the Navarro (Cretaceous) formation since 1912.

The most prolific formation from the standpoint of cumulative production is the Woodbine formation of East Texas, which had produced 3,952,706,599 bbl. through 1954. In addition, the Woodbine formation had the greatest average field cumulative production at the end of 1954, averaging 63,753,332 bbl. per field. The Woodbine per acre and per acre-foot recoveries through 1954 were 4,086 bbl. and 227 bbl., respectively. It must be remembered, however, that the data on the East Texas field dominate the Woodbine statistics.

The Strawn (Pennsylvanian) formation of North Texas boasted 284 fields, which was the greatest number of fields. These fields had an average cumulative field production through 1954 of 1,139,219 bbl.

The Frio (Oligocene) formation of the Upper Gulf Coast leads Texas in recoveries per acre and per acre-foot. Average cumulative production in these categories through 1954 from the Upper Gulf Coast Frio was 5,614 bbl. per acre and 299 bbl. per acre-foot.

Total production and per field production during 1954 was led by the Woodbine formation with a total production for the year of 112,816,202 bbl. and a per field production of 1,819,616 bbl.

It is not possible to compare the productive area or number of wells for the various formations since complete information was not available. The average cumulative recoveries per acre and per acre-foot shown were calculated only from those fields with sufficient information to do so.

Two tables are included with this summary. Table 1 presents the relative importance of the various formations with respect to order of discovery, number of fields, production to the end of 1954, production during 1954, and cumulative production through 1954 of barrels per acre, barrels per acre-foot, and average recovery per field, and Table 2 contains the totals and averages of the various formations from the booklet, "Oil Production History of the Southwest."

Author is petroleum engineer, Bank of the Southwest, Houston.

EXPLORATION

TABLE 1—RELATIVE IMPORTANCE OF PRINCIPAL TEXAS PRODUCING FORMATIONS

					Through 1954		
Rank	Order of discovery	Number of fields	Production to end of 1954	Production during 1954	Cumulative recovery per acre, bbl.	Cumulative recovery per acre-foot, bbl.	Average cumulative recovery per field, bbl.
1	Navarro	Strawn, NT	Woodbine	Woodbine	Frio, UGC	Frio, UGC	Woodbine
2	Woodbine	Bend, NT	San Andres	San Andres	Woodbine	Cockfield	San Andres
3	Frio, LGC	Frio, LGC	Frio, UGC	Frio, UGC	Frio, MGC	Frio, MGC	Cockfield
4	Glen Rose	Frio, UGC	Grayburg	Frio, LGC	Wilcox, MGC	Wilcox, MGC	Grayburg
5	Grayburg	Strawn, WT	Cockfield	Ellenburger, WT	Cockfield	Frio, LGC	Frio, UGC
6	San Andres	Ellenburger, WT	Frio, LGC	Strawn, NT	Frio, LGC	Woodbine	Frio, MGC
7	Strawn, WT	Strawn, NCT	Ellenburger, WT	Frio, MGC	Yegua	Yegua	Ellenburger, WT
8	Frio, UGC	San Andres	Frio, MGC	Grayburg	Ellenburger, WT	Eagle Ford	Frio, LGC
9	Yegua	Frio, MGC	Strawn, NT	Canyon, WT	Wilcox, UGC	Carrizo	Glen Rose
10	Bend	Yegua	Yegua	Strawn, WT	Eagle Ford	Wilcox, UGC	Canyon, WT
11	Frio, MGC	Caddo	Glen Rose	Cockfield	San Andres	Gray	Yegua
12	Cockfield	Woodbine	Canyon, WT	Yegua	Grayburg	Caddo	Wilcox, MGC
13	Strawn, NT	Wilcox, UGC	Bend	Glen Rose	Canyon, WT	Strawn, NT	Eagle Ford
14	Eagle Ford	Glen Rose	Strawn, WT	Strawn, NCT	Carrizo	Bend	Strawn, NT
15	Wilcox, MGC	Ellenburger, NCT	Wilcox, MGC	Bend	Strawn, WT	Canyon, NCT	Cook
16	Ellenburger, WT	Canyon, NCT	Wilcox, UGC	Wilcox, MGC	Glen Rose	Ellenburger, NCT	Wilcox, UGC
17	Wilcox, UGC	Canyon, WT	Eagle Ford	Canyon, NCT	Canyon, NCT	Cook	Ellenburger, NT
18	Canyon, NCT	Wilcox, MGC	Strawn, NCT	Navarro	Bend	Glen Rose	Strawn, WT
19	Ellenburger, NT	Navarro, SCT	Ellenburger, NT	Eagle Ford	Ellenburger, NT	Strawn, NCT	Navarro
20	Caddo	Grayburg	Canyon, NCT	Wilcox, UGC	Caddo	Strawn, WT	Canyon, NCT
21	Wilcox, SCT	Ellenburger, NT	Navarro	Ellenburger, NCT	Strawn, NT	Ellenburger, NT	Carrizo
22	Gray	Cockfield	Cook	Caddo	Wilcox, SCT	Grayburg	Bend
23	Strawn, NCT	Eagle Ford	Caddo	Carrizo	Gray	Canyon, WT	Strawn, NCT
24	Cook	Cook	Ellenburger, NCT	Ellenburger, NT	Ellenburger, NCT	Navarro	Wilcox, SCT
25	Ellenburger, NCT	Gray	Carrizo	Cook	Strawn, NCT	San Andres	Caddo
26	Carrizo	Carrizo	Wilcox, SCT	Gray	Navarro	Wilcox, SCT	Ellenburger, NCT
27	Canyon, WT	Wilcox, SCT	Gray	Wilcox, SCT	Cook	Ellenburger, WT	Gray

See Table 2 on pages 222-223

HELPS TURN PROMISE INTO PAYOFF!

HALLIBURTON'S MCA MUD CLEANOUT AGENT

When the drill stem test indicates a promising potential, the well's ability to fulfill that promise depends a lot on completion procedures. Halliburton's MCA (Mud Cleanout Agent) helps soften and disperse mud cake and prepares bore walls and formations for more effective completion. By restoring the permeability of the pay zone, MCA aids in turning potential into production.

REMOVES MUD BLOCKS

MCA employs two highly efficient chemicals to do the job: 1. Hydrochloric acid to shrink bentonitic materials and to react chemically with the filter cake; 2. Morflo, a powerful surfactant, to soften the filter cake, disperse its particles, and make possible easy recovery of the treating fluid and mud solids.

AIDS REMEDIAL WORK

Remedial work to revive production in older wells is often made more effective by removing accumulations of materials that plug flow channels. MCA improves fracturing by removing mud from perforations and by cleaning surfaces for a more intimate contact with fracturing fluids. Fracturing pressures can often be lowered and injection rates usually can be increased.

Let Halliburton's MCA help you turn promise into pay-off. If production falls short of potential, call your local or district office of the Halliburton Oil Well Cementing Company, Duncan, Oklahoma.

COMPLETE DATA SENT ON REQUEST

Add this valuable information to your Halliburton Service File

HALLIBURTON
CHEMICAL SERVICES

251 SERVICE CENTERS – JUST MINUTES AWAY FROM ANY RIG

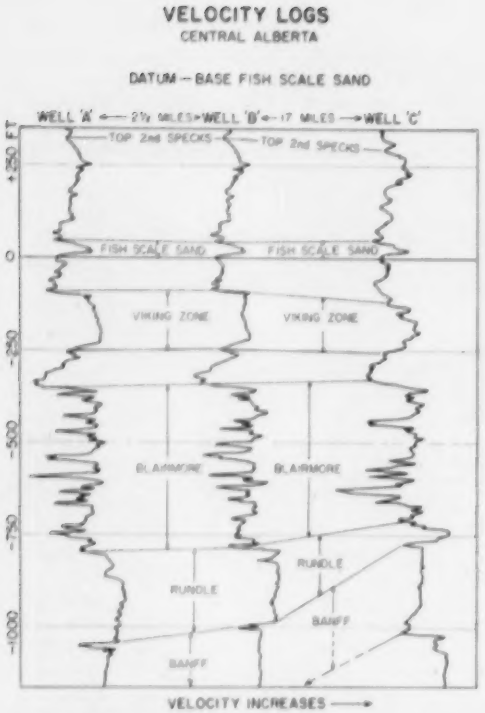
Table 2–Principal Pro

Location and formation:	Year of discovery		Number of fields	Area proved, acres*	Production to end of 1954
EAST:					
Eagle Ford (Upper Cretaceous)	1935	Totals	22	18,569	30,853,802
		Averages			
Glen Rose (Trinity) (Lower Cretaceous)	1924	Totals	54	63,703	127,895,774
		Averages			
Woodbine (Upper Cretaceous)	1920	Totals	62	214,400	3,952,706,599
		Averages			
GULF COAST, LOWER:					
Frio (Oligocene)	1920	Totals	170	84,160	409,606,928
		Averages			
GULF COAST, MIDDLE:					
Frio (Oligocene)	1931	Totals	79	41,720	389,672,815
		Averages			
Wilcox (Eocene)	1935	Totals	43	10,000	62,981,649
		Averages			
GULF COAST, UPPER:					
Cockfield (Eocene)	1931	Totals	29	31,337	422,144,204
		Averages			
Frio (Oligocene)	1927	Totals	148	57,143	978,383,613
		Averages			
Wilcox (Eocene)	1936	Totals	59	16,540	48,393,406
		Averages			
Yegua (Eocene)	1928	Totals	79	16,205	142,432,112
		Averages			
NORTH:					
Bend (Pennsylvanian)	1928	Totals	217	40,645	79,804,681
		Averages			
Ellenburger (Ordovician)	1939	Totals	35	13,580	24,783,571
		Averages			
Strawn (Pennsylvanian)	1931	Totals	283	48,680	322,398,994
		Averages			
NORTH CENTRAL:					
Caddo (Pennsylvanian)	1939	Totals	66	10,700	12,117,810
		Averages			
Canyon (Pennsylvanian)	1937	Totals	50	20,030	20,618,571
		Averages			
Cook (Pennsylvanian)	1946	Totals	19	18,910	18,551,418
		Averages			
Ellenburger (Ordovician)	1946	Totals	51	8,040	8,842,516
		Averages			
Gray (Pennsylvanian)	1941	Totals	19	2,380	2,919,239
		Averages			
Strawn (Pennsylvanian)	1941	Totals	97	31,219	29,363,180
		Averages			
SOUTH CENTRAL:					
Carrizo (Eocene)	1946	Totals	14	1,930	5,344,622
		Averages			
Navarro (Cretaceous)	1912	Totals	37	23,270	19,543,820
		Averages			
Wilcox (Eocene)	1940	Totals	13	1,600	3,164,206
		Averages			
WEST:					
Canyon (Pennsylvanian)	1948	Totals	48	47,020	102,739,808
		Averages			
Ellenburger (Ordovician)	1935	Totals	100	101,235	390,393,056
		Averages			
Grayburg (Permian)	1925	Totals	36	118,970	425,544,223
		Averages			
San Andres (Permian)	1926	Totals	94	403,001	1,387,721,266
		Averages			
Strawn (Pennsylvanian)	1926	Totals	101	42,627	70,769,944
		Averages			
Total all formations			2,025	1,487,614	9,489,691,827
Averages all formations					

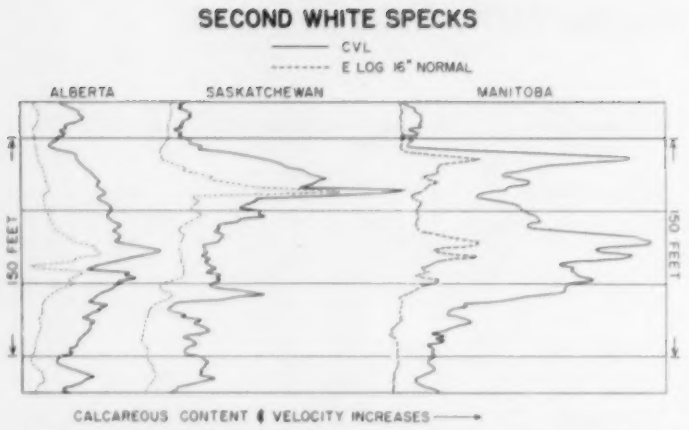
*Information in these columns was not complete for all the fields included in the study.

ducing Formations in Texas

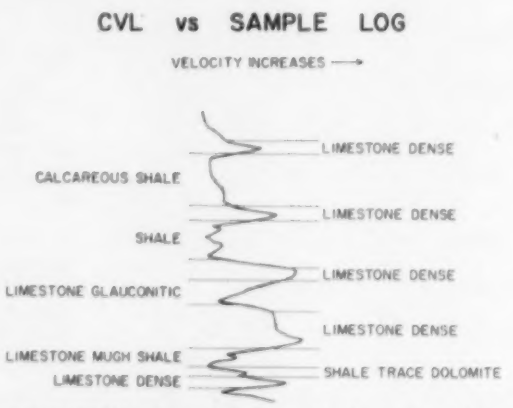
Production during 1954*	Wells producing December 1954*	Gravity, °A.P.I.*	Average net productive thickness, ft.*	Acre-feet*	Through 1954 — Cumulative recovery per acre, bbl.	Through 1954 — Cumulative recovery per acre-foot, bbl.	Through 1954 — Recovery average per field, bbl.
3,608,302	707	25	10	175,650	1,432	162	1,402,446
8,972,108	1,229	43	18	1,209,021	915	54	2,368,440
112,816,202	22,202	35	19	8,292,827	4,086	227	63,753,332
55,902,108	6,290	38	12	690,260	2,517	257	2,409,453
27,612,699	2,718	35	19	2,619,240	4,033	264	4,932,567
7,356,524	626	35	20	179,340	3,945	263	1,464,690
14,288,266	1,586	37	14	857,750	3,649	270	14,556,697
56,488,811	3,120	34	22	3,083,702	5,614	299	6,610,700
3,038,046	321	39	40	418,490	1,676	103	820,227
13,258,403	1,155	39	12	149,340	2,128	199	1,802,938
7,938,666	1,323	42	21	1,089,545	853	72	367,764
562,986	251	41	33	365,280	835	47	708,102
32,062,159	6,465	40	16	680,670	809	85	1,139,219
1,258,992	218	41	16	157,800	834	86	183,603
4,369,548	554	40	19	378,090	857	58	412,371
475,971	475	38	10	12,260	500	55	976,390
1,567,262	148	43	22	270,710	728	58	173,383
269,113	70	43	12	35,500	772	91	153,644
8,906,952	923	40	14	841,600	627	54	302,713
891,811	128	24	11	23,150	1,115	154	381,759
3,838,467	1,761	35	18	514,760	572	40	528,211
215,197	44	35	20	51,140	798	33	243,400
19,348,686	5,803	41	38	4,578,420	1,165	41	2,140,413
47,837,764	1,407	45	115	23,568,185	1,842	26	3,903,931
25,700,684	4,269	31	39	10,315,080	1,198	42	11,820,673
74,294,892	11,224	32	43	49,194,337	1,229	34	14,762,992
18,172,101	1,293	41	26	1,452,262	970	50	700,693
551,052,720	76,310	37	24	111,204,409	1,693	116	4,686,268



FORMATION BREAKS can be recognized and correlated on these three velocity logs. Fig. 1.



THE SECOND WHITE SPECKS formation becomes more calcareous to the east, causing an increase in velocity. Fig. 2.



COMPARISON of a velocity log with the lithology shows that velocity is related to lithology. Fig. 3.

A new exploration tool—
It's the . . .

CONTINUOUS VELOCITY LOG

Magnolia's new development should prove useful in (1) quantitative determination of porosity, (2) in qualitative detection of hydrocarbons, and (3) in some cases, the actual location of fluid contacts

by Eric M. Denton

SEVERAL types of acoustic-interval velocity logs are now available to the oil-exploration industry. Their use has become important to the geophysicist. More precise velocity data are now made available for seismic depth determinations; synthetic seismograms from velocity logs aid in identifying reflections. In addition, more precise knowledge of the seismic velocity section makes for better understanding of the actual mechanics of reflection generation.

Although acoustic-interval velocity logs have so far been used almost exclusively for the above purpose, they can also be of interest to geologists and petroleum engineers. Previous papers have shown how velocity logs may be used for identifying and correlating lithologic boundaries between wells. However, a velocity log may be used for ascertaining porosities and detecting hydrocarbons.

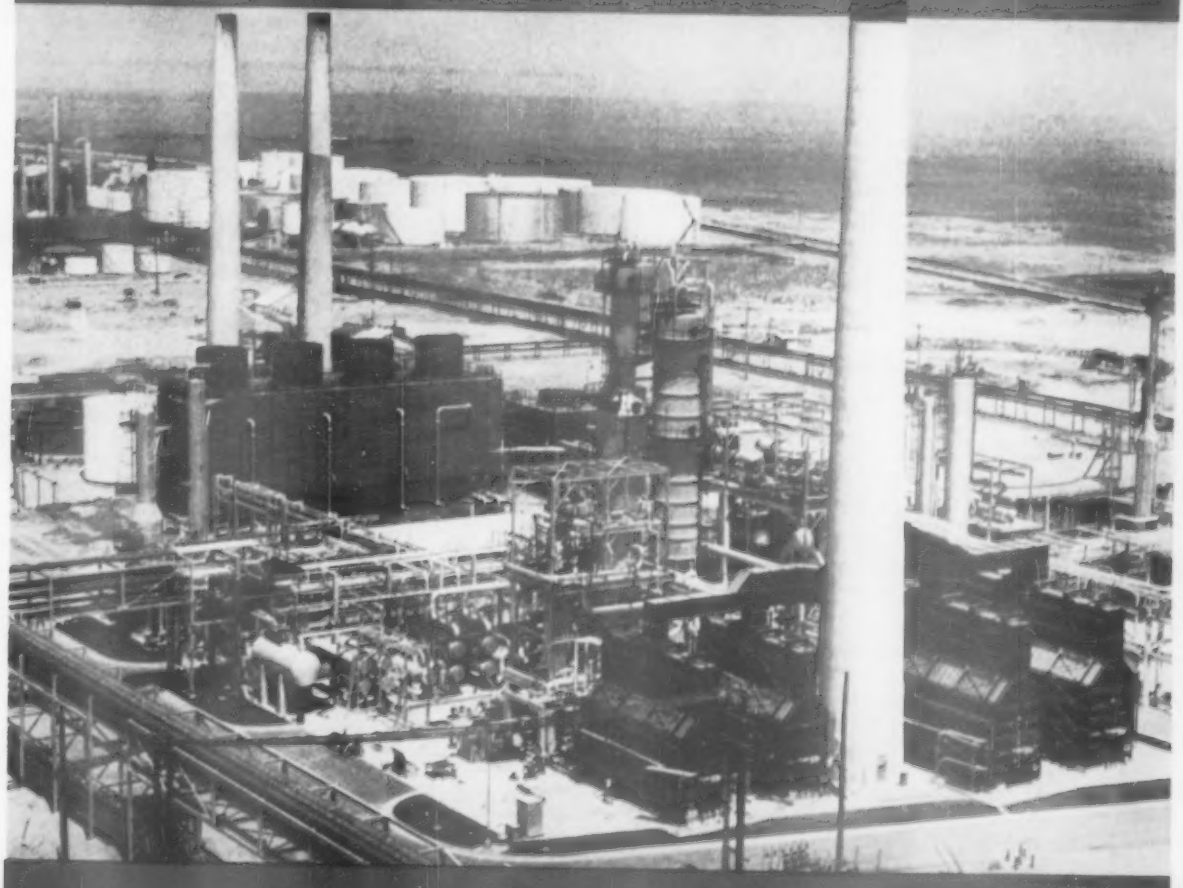
This includes the quantitative determination of porosity in terms of actual percentages, the qualitative detection of hydrocarbons, and, in some cases, the actual location of fluid contacts. These conclusions have become apparent after reviewing velocity logs from more than 100 Canadian wells. Most operators agree they cannot get too much of this type of information for their wildcat wells. Velocity logs may therefore be-

EXPLORATION

MILLION GALLON THIRST

A desulfurizer unit that "drinks" a million gallons of raw gasoline materials a day to deliver an equal amount of purified product . . . a fluid coking plant four times larger than any now in operation . . . a new gas processing plant—these newly completed units are part of a major expansion program at Tidewater Oil Company's Avon Flying A Refinery.

Design, procurement and construction were responsibilities of the Bechtel organization—a fully integrated project under single responsibility.



BECHTEL

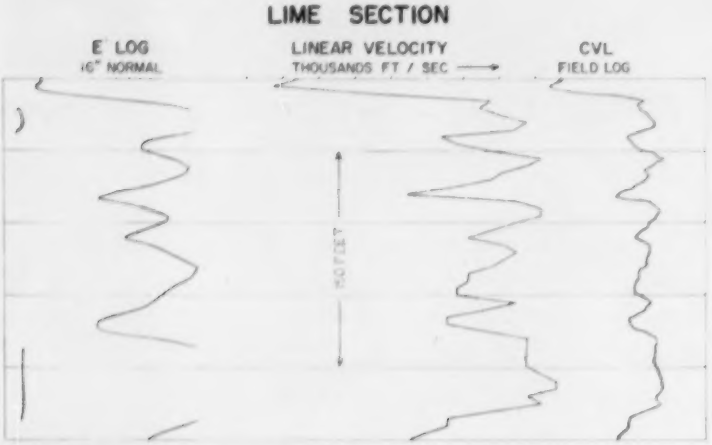
BECHTEL CORPORATION

BUILDERS FOR INDUSTRY

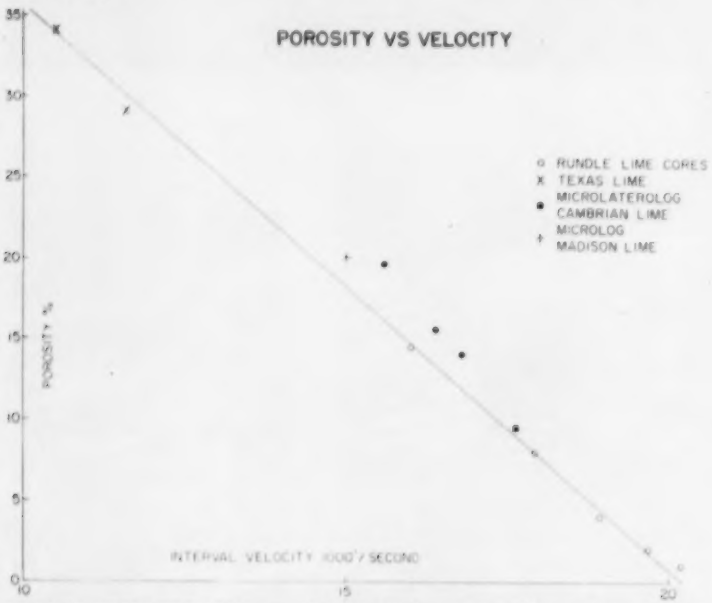
SAN FRANCISCO

Los Angeles • New York • Houston

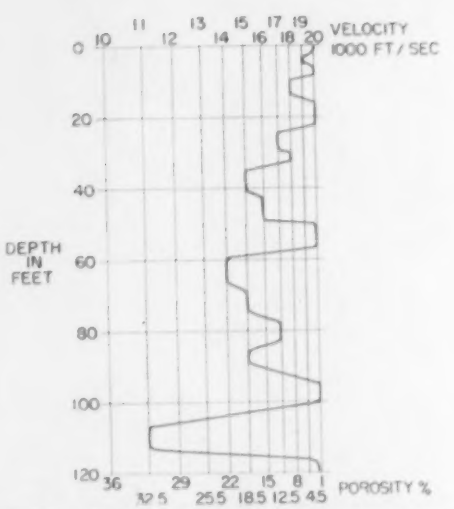
CANADIAN BECHTEL LIMITED • Toronto • Vancouver



THE CONTINUOUS VELOCITY LOG can be related to formation factor and to porosity. Fig. 4.



IN LIMESTONE SECTIONS, porosity and velocity appear to have a linear relation. Fig. 5.



HERE, a hypothetical velocity log is superposed on a porosity template to show how porosities in a limestone might be determined from velocity data. Fig. 6.

THE AUTHOR

Eric R. Denton is velocity engineering supervisor, Seismograph Service Corp. of Canada, Calgary. He graduated from University of Western Australia in 1948 with the degree of bachelor of science in physics. He served with Seismograph Service in the Middle East and Europe and joined the Canadian subsidiary in 1951. Denton has been closely associated with velocity logging since its inception. After studying the method in West Texas and the Mid-Continent, he returned to Canada in 1954 and has worked with the logging and interpretation of continuous velocity surveys for the past 2 years.

come a useful adjunct to the other logs and data which are already being recorded.

The log discussed here is known as the continuous velocity log,[2] a development of Magnolia Petroleum Co.

The general equation relating the velocity curve to lithologic character is:

$$V_L = [(k + 4/3\ n)/\rho]^{1/2}$$

$$= (\text{Elasticity}/\text{Density})^{1/2}$$

Where:

V_L = longitudinal acoustic velocity
k = bulk modulus of elasticity
n = shear modulus of elasticity
ρ = density

According to this equation dense rocks should have lower acoustic velocities. This is not so, however, for sedimentary rocks, because the higher density has usually been obtained by increased compaction which results in an increase in elasticity. The resultant increase in elasticity outweighs the effects of variations in density. Changes depicted by a continuous velocity log may therefore be safely considered as changes in the elasticity of the formations logged. As such, the log can be used for making correlations between wells and for picking lithologic boundaries. Fig. 1 shows three continuous velocity logs arranged side by side to illustrate this conclusion.

To proceed further with the interpretation of the log it is necessary to consider the factors on which the elasticity of a rock depends. Any interpretation made without regard to all of these factors cannot be reliable.

The most important are: Matrix material—load, lithology. Porosity—fluid content.

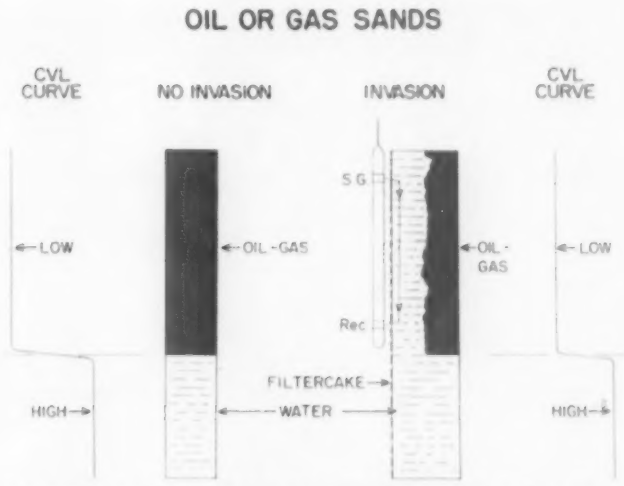
Load or Matrix Pressure

Although important when dealing with unconsolidated sediments of Tertiary or more recent age, variations in load are fortunately not important when dealing with formations which may be regarded as potential oil reservoirs in the Canadian section. When seeking reasons for the variation of velocity with depth in a bed in any particular well it may be neglected entirely.

Lithologic Matrix

This factor is of major importance and is best studied by reference to some field examples.

Fig. 2 shows velocity logs and electric logs of the Second White Specks



THE VELOCITY CURVE is affected by original fluid content of the formation even in zones that have been flushed by the mud filtrate. Fig. 7.

formation in three wells. Locations range from Central Alberta to Manitoba. The formation becomes more calcareous to the east. For this reason an increase in velocity would be expected. Conversely, it demonstrates the decrease in velocity which accompanies increased shale content in a limestone. The same trends are apparent in the vertical section shown in Fig. 3 which compares a velocity log with the geologist's sample log.

This variation of velocity with shale content is also found in sands which usually have velocities lower than limestones. The decrease in velocity observed with increased shale content seems only to apply when the shale actually replaces some of the lime or sand. If the latter remain constant, but have shale occupying the pore space, an increase in velocity takes place on entering the shaly sand or lime. This can lead to confusion, especially in sand beds.

The electric-log 16-in. normal device curves have been shown in the Second White Specks example to illustrate the usual relationship between velocity and resistivity. Increasing resistivity is accompanied by increasing velocity. Later examples will show that this is not always the case.

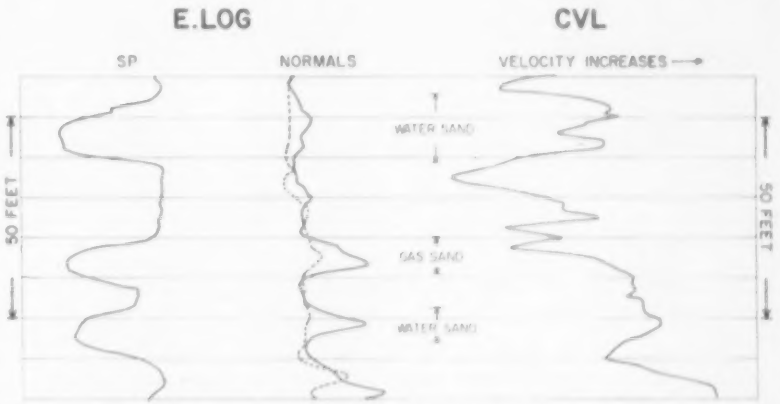
Porosity

Should it be possible to establish, either from drill cutting or any other log run, that a certain section has a matrix of fairly constant composition, and provided that no water-to-hydrocarbon-fluid changes occur, then velocity variations may be interpreted as being variations in porosity.[8]

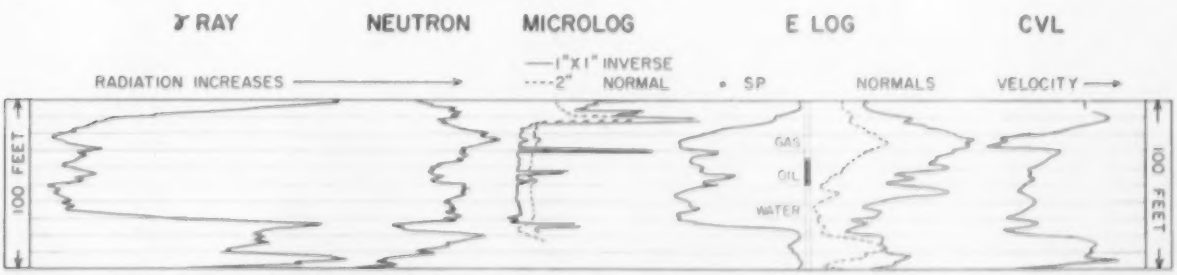
Fig. 4 provides an example by comparing velocity with the 16-in. normal of the electric log. As the section is composed of clean limestone it is reasonable to assume that the electric log is related to formation factor and therefore in turn to the porosity.

To find the empirical relationship between velocity and porosity in limestones, available core data were used. Indicated porosities from cores were averaged over 6-ft. intervals and corresponding velocities were picked from the velocity log. The results are plotted in Fig. 5. As no available cores showed porosities above 14 per cent for any 6-ft. section, no points from a Canadian source appear at the high porosity end of the curve. This end of the curve was therefore fixed by two points determined from work in the United States by Magnolia Petroleum Co. Porosity determinations from a Schlumberger Microlaterlog were also plotted for some Canadian wells, but these show an increasing divergence from the core-analysis curve at higher porosities.

The resulting curve appears quasi-linear. Data are unfortunately sparse and, for the production of a reliable curve, many more points will need to be plotted. When additional data become available to further confirm such a curve, it will be possible to construct a template of the type shown in Fig. 6. This diagram assumes the curve derived in Fig. 5 to be correct. By placing the 1 per cent porosity line against a known dense section, porosities at other points



THE VELOCITY LOG helps in determining if the sands will produce and can supplement electric log interpretation. Fig. 9.



IN THIS EXAMPLE, a change in fluid content of the sand is observed on the velocity log, although the fluid content cannot be determined accurately because of the shale content. Fig. 8.

are determined. A hypothetical log has been drawn to scale to show the magnitude of velocity variations as they would appear on a field log for various porosities.

Fluid Content

The effects of matrix material and porosity on the acoustic transmission velocity of a rock have been briefly discussed. In any bed of relatively constant composition and porosity, the velocity as recorded by a velocity log will remain constant if the fluid saturating the bed is of the same type throughout the vertical section logged. Above condition will exist in water sands as variations in the velocity of brine solutions, within the range of concentrations usually encountered, are too small to be measured by the log.

However, if fluid hydrocarbons, which have low acoustic velocities, replace the water in any particular zone a decrease in velocity will be observed on the log. Examples of sand beds will be shown to prove that this condition is fulfilled in practice. As the presence of hydrocarbons will be recorded on an electric log as an increase in resistivity we will now have the usual velocity-resistivity relationship reversed. This provides us with a method of oil or gas detection.

A quantitative approach as to the amount and nature of the hydrocarbons present is not available as yet, although gas sands would be expected to have lower velocities than oil sands, other factors being equal. A serious obstacle to quantitative determinations is the problem of filtrate invasion. At the time of logging, many beds containing oil or gas are flushed by the invasion of the mud filtrate up to a distance of several inches from the hole wall. Indeed, for some of the examples to follow, it was necessary to assume zero residual hydrocarbon content in the flushed zone to obtain porosities which approached those obtained from core analysis.

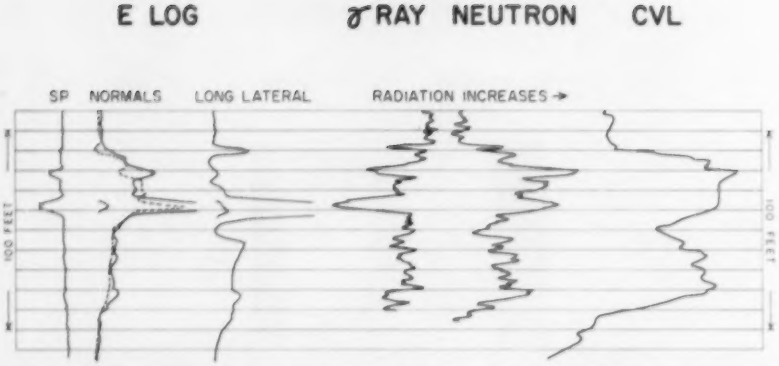
Fig. 7 illustrates the conditions encountered when logging invaded and noninvaded oil or gas sands. It seems axiomatic that the travel path measured by a velocity log is the travel path of least time. In oil and gas sands this may safely be assumed to be the path through the flushed zone just behind the hole wall. The ability of a velocity log to detect very small quantities of hydrocarbons in flushed zones is therefore not reasonably explained by a simple reference to the velocity difference which exists between the formation water and the hydrocarbon, even if the residual amount of hydrocarbon present in the flushed zone be known. There is some doubt as to whether the latter can ever be determined accurately.[4]

It seems more likely that the low velocities, recorded in sections containing very small amounts of residual hydrocarbons, are due to an increase in the acoustic impedance brought about by surface phenomena occurring at the many boundaries between the formation matrix, connate water and residual hydrocarbons. A quantitative approach would seemingly have to take into account the distribution of residual hydrocarbons as well as their amount. When residual gas is present, the sharp decrease in velocity has been well explained by Wood;[5] he has shown that water containing as little gas as 1 part in 10,000 may have its acoustic transmission velocity decreased by as much as 40 per cent.

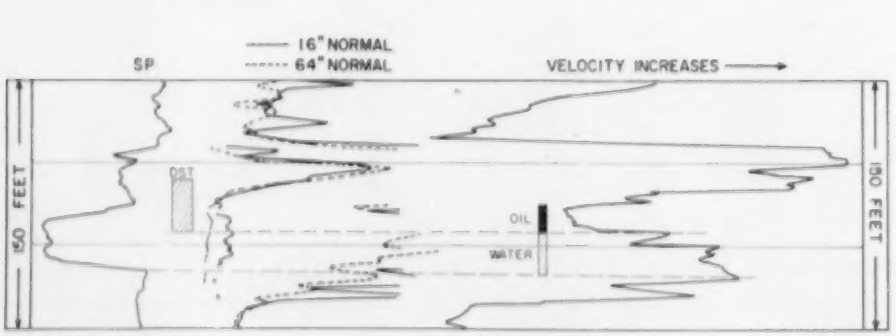
To demonstrate the behavior of a velocity log in beds containing hydrocarbons it may be as well to start with the first log on which such events were noted in 1954. Of this particular well a MicroLog and radiation log were released for comparison purposes. Fig. 8 shows these logs for a particular sand bed. It is contaminated by shale, but seems to be of fairly constant porosity. Core data released at a later date showed that the porosity increases slightly with depth. Thus we would expect the velocity log to record either a decreasing velocity towards the base of the sand or at least a substantially constant velocity over the entire bed.

Fig. 8 also shows the velocity log for this section having a low velocity break at the top of the sand. A fluid change was therefore postulated. Reference to the electric log and the established fluid contacts shows this assumption to be correct. The oil zone and the fluid contacts are not defined in this case due most probably to contamination of the sand by shale.

In Fig. 9, the upper sand is obviously water-bearing by reference to the electric log. The low velocity kick must therefore be due to a porosity break. The sample log and the MicroLog showed this sand to have the best poros-

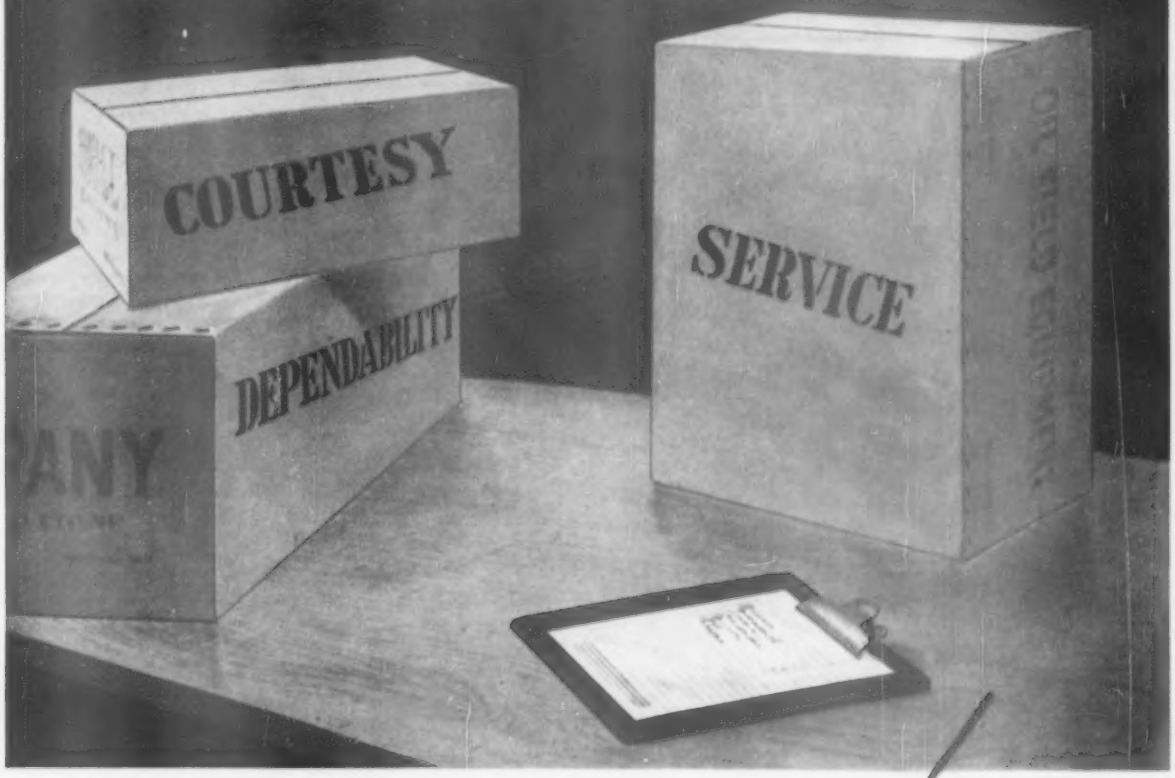


HERE THE UPPER SAND is water-bearing. The lower sand is oil-saturated although the velocity log cannot positively identify the hydrocarbon zone. Fig. 10.



THE OIL-WATER contact in this sand is shown by an increase in velocity. Fig. 11.

BE SURE EVERY ORDER INCLUDES THESE IMPORTANT ITEMS . . .



you get all three when you buy from UNITED SUPPLY

When a United Supply store writes up your order—whether you drop by on the way to the rig or make a hurried call for help over the phone—you can be sure that your order will include Courtesy, Service and Dependability. Yes, you don't have to ask for these important items at United Supply – they automatically come with every order.

UNITED SUPPLY

YOU CAN RELY ON UNITED SUPPLY!
UNITED SUPPLY
COURTESY • SERVICE • DEPENDABILITY

AND *Manufacturing* COMPANY
TULSA, OKLAHOMA
Stores in: KANSAS, OKLAHOMA, TEXAS, LOUISIANA, AND NEW MEXICO
COURTESY • SERVICE • DEPENDABILITY

ity of the three. If the middle sand has a porosity lower than the upper sand, then the low velocity at the top of the middle sand must be due to the presence of hydrocarbons. A drill-stem test over this sand gave gas to the surface in 1 minute at a rate of 4 M.M.c.f.d.

The middle sand having proved to be productive, a casual inspection of the electric log may lead to the belief that the lower sand could also produce. The MicroLog shows it to have a porosity as good as the middle sand. Such a prediction is not confirmed by the velocity log which shows the sand to be most likely wet and probably tighter. The porosity prediction was confirmed by the sample log. The lower sand is shaly and the MicroLog porosity is thus optimistic. A drill-stem test on this sand gave a recovery of mud.

The well was completed as an 8-M.M.c.f.d. gasser from perforations spaced over the upper 4 ft. of the middle sand. The velocity log is here almost at its limit with regard to resolution of the various zones present due to its 5.92-ft. spacing. The true velocity of the gas sand is thus lower than indicated. It can also be seen that the velocity log is not independent of other logs for such interpretations. Reference is made to the shale bed just above the gas sand which has caused a low velocity break to appear on the continuous velocity log.

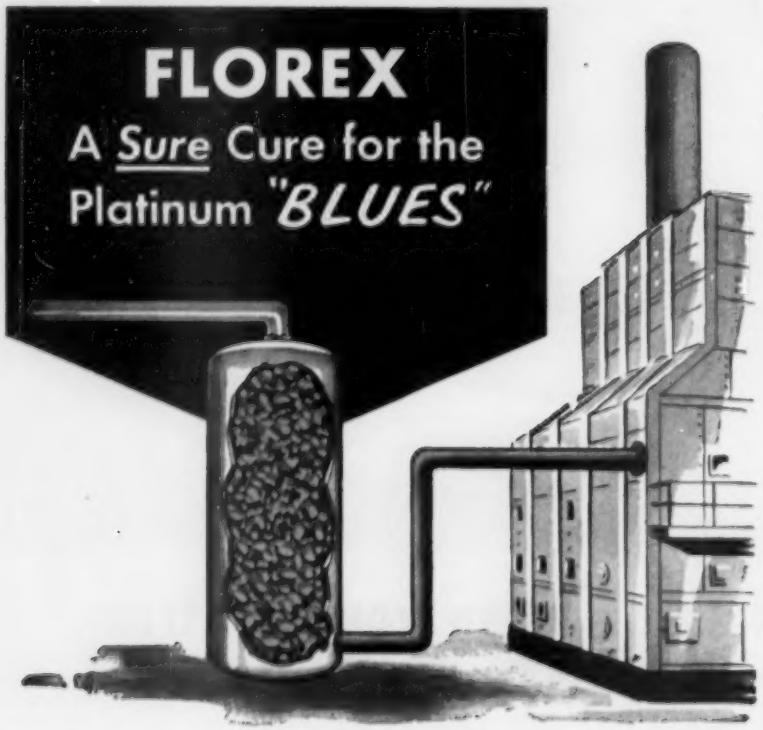
The next example has been included to serve as an introduction to the final example. It differs from the others in that it is from a field-development well and not a wildcat. Two sands are shown by the S.P. curve in Fig. 10. The upper sand is not productive as would be expected from the velocity-resistivity relationship. The recorded velocity is below true velocity as the bed thickness is less than the tool spacing. The lower bed is an oil sand over its entire vertical extent. No water has been found in this field to date. The absence of a water sand to produce a velocity break beneath the oil sand renders the velocity log incapable of positively identifying this hydrocarbon zone. For a positive identification, a velocity for the same sand when wet would have to be obtained in another well. In this case such a velocity could not be obtained as the field limits are set by the existence of porosity in the sand.

The velocity log of Fig. 11 was run for the usual purpose of securing velocity data for a seismograph survey which had been conducted in the area. A published report in a trade journal later gave the result of a drill-stem test in this well as being a 1,500-ft. rise of clean oil over a certain section. No water was recovered or mentioned.

The velocity log (Fig. 11) was inspected and showed a low velocity break 15 ft. thick at the bottom of the section tested. As no other data were available, it was assumed that this was the extent of the oil-saturated sand and that the increase in velocity below this section was due to a lithologic change and not water. With no water sand established, it was felt that this example was similar to the preceding one.

However, an application was made to the company concerned for the release of other logs. The electric log, which is also reproduced in Fig. 11, shows the sand to be not 15 but over 30 ft. thick, and the sample log indicates that it is very clean.

The operator reported the following case history of the discovery. Due to the fact that no water was obtained by the drill-stem test, and as none was thought to be indicated by the electric log, it was assumed that the entire sand was oil saturated. The sand was perforated accordingly, but water was obtained during the production tests. It would seem that the confusion was caused by the 64-in. normal curve which appears plotted on two scales simultaneously. The water situation was remedied by plugging back; by this



The growing use of platinum catalysts in reforming feed stock emphasizes the importance of pre-removing trace metals such as arsenic, lead and sulphur compounds. Platinum catalysts are poisoned by these substances in quantities even as small as ten parts per billion.

Treating the feed stock before the trouble occurs, Florex adsorbent provides the simplest, most economical means to protect expensive catalysts. Florex in the granular grades will completely remove or reduce these compounds to a harmless level.

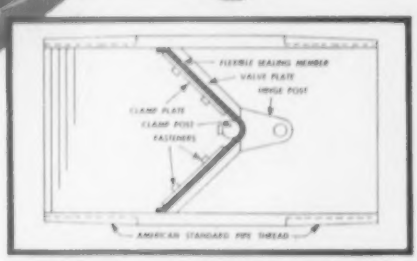
Recognized throughout the world as superior to all other natural clays, Florex is prepared from carefully selected Florida Fuller's Earth by a special processing, including high pressure extrusion.

Meshes from 8/16 and up are customarily used. Write for information today.

FLORIDIN COMPANY
Adsorbents
Desiccants
Diluents

Dept. C Box 989 Tallahassee, Florida

NOW A UNIQUE MULTI-PURPOSE CHECK VALVE



SILENT • SEATLESS • LOW PRESSURE DROP

Technocheck©-MP

OUTPERFORMS • OUTWEARS OTHER VALVES • COSTS LESS TO MAINTAIN

Technocheck-MP is a highly efficient check valve that has a wide range of industrial applications. Its unique design eliminates the need for valve seats and permits use in low or high pressure service. Tight sealing, low pressure drop across valve and long life with low upkeep are Technocheck-MP characteristics. Valves are produced in numerous metals and alloys as well as in polyvinyl chloride for use in PVC piping systems. They are made in standard or custom designs, and in threaded or flanged ends.

Write for Bulletin

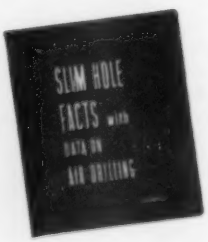
Techno Corporation
16 West 5th Street, Erie, Pa.

Arnold Lewis says..."When it comes to Slim Hole Drilling...

I use a

IT'S ALL IN "SLIM HOLE FACTS"—

3rd EDITION! Comprehensive and complete, this fact-finding well of information contains 225 pages covering economic and equipment considerations of Slim Hole Drilling. Free to contractors and oil company executives. Write Cardwell Manufacturing Co. on your letterhead.

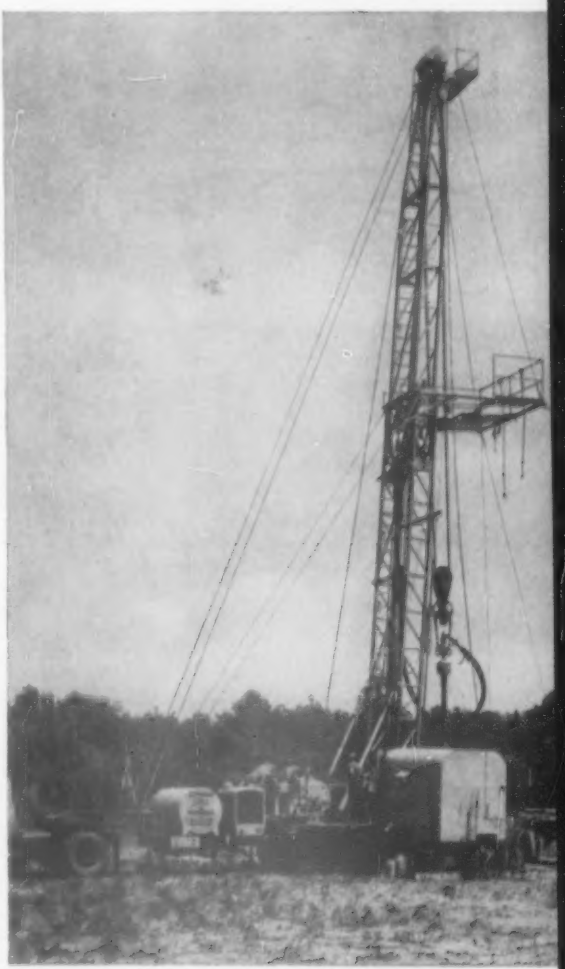


Three Man Crew"

Using a completely portable Cardwell Model AL rotary rig, equipped with a Cardwell Model 100 mast, Arnold L. Lewis—doing business as Lewis Drilling Company out of Princeton, Indiana—has found "reduced manpower . . . drilling equipment . . . and hole size makes Slim Hole Drilling with Cardwell equipment the most economical and efficient method for both producer and drilling contractor."

This Cardwell rig using automatic cathead is handled very efficiently and economically by a three-man crew. Not only is there a decided saving in drilling and completion costs, but moving, rig-up and rig-down time are saved—adding to the efficiency of this type of Slim Hole drilling.

Cardwell's Model AL, a single engine mechanical driven hoist, has a Slim Hole depth rating of 4,000 feet using 2⅞ inch drill pipe. For rotary drilling, depth rating is 2,000 feet with 4½ inch drill pipe or 2,500 feet with 3½ inch drill pipe. As a servicing or rotary workover, the rating is to 5,000 feet. Nominal input rating of the Model AL is 120 horsepower. New alloy steels make the unit tougher . . . but lighter. It is specifically designed to combine fast operating speeds with extreme portability.



SEE FOR YOURSELF!

the new

cardwell MANUFACTURING COMPANY

BOX 2001, WICHITA, KANSAS, U. S. A.

REPORTS OF PERFORMANCE

from users during the past 16 years show that Kennametal* lasts 20 times longer than steel and 3 to 5 times longer than special and super alloys.

• A Texas producer reported sand abrasion forced a pulling job every 14 to 20 days. After 448 days on the job, Kennametal Balls and Seats showed no wear when well was pulled for other than valve job.

INDUSTRY AND **KENNAMETAL**
...Partners in Progress

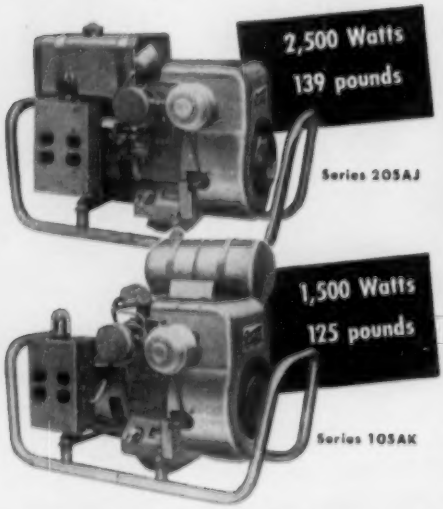
Kennametal API Balls and Seats are available at repair shops of most major pump manufacturers. Ask your service man to standardize on them. They'll cost you less in the long run. KENNAMETAL INC., Latrobe, Pennsylvania.

*Kennametal is the Registered Trademark of a series of hard carbide alloys of tungsten, tungsten-titanium and tantalum.

B-1940

YOU GET *4-cycle* DEPENDABILITY AND *Light weight* TOO . . . IN AN

ONAN Electric Plant



These power-packed electric plants give you all the *4-cycle* advantages of quick starting, long life and trouble-free operation . . . with an amazing weight saving over usual 4-cycle plants. You can carry them easily to any spot . . . and you can count on them delivering their full rated capacity as long as you need it. Both are single-cylinder, air-cooled . . . completely equipped and ready to go.

Other models to 50,000 watts.

Write for special folder on lightweight models!

D. W. ONAN & SONS INC.

Onan ELECTRIC PLANTS

3582 University Ave. S. E., Minneapolis 14, Minnesota

means, the oil sand was found to be limited to the upper 15 ft. of the bed. The oil-water contact is at the point shown by the major break on the continuous velocity log.

Conclusions

Until a direct method of locating hydrocarbons in sands becomes available, it is believed that acoustic-interval velocity logs can be of considerable assistance in present-day, planned, logging programs.

Likewise, additional and more precise quantitative porosity values appear to be possible, at least in limestones, from velocity readings. Confidence built up in such determinations will reduce coring costs in normal limestones and will provide the reliable figures in highly porous limestones which heretofore have been available only from cores.

Much remains to be done in the field of endeavor covered by this article. It is hoped that the oil industry will apply these basic ideas to the data already accumulated with a view to further evaluation and evolution of the techniques discussed. The release, to a service company, of complete geological data, logs, and completion information is not always possible. Accordingly, individual studies within oil companies are indicated and the possibility of freer release of data might be considered.

Acknowledgments

The author wishes to thank Seismograph Service Corp. of Canada for permission to publish this paper. Special appreciation is also extended to the five oil companies which made their well data available for this discussion. It is understood that W. G. Hicks and J. E. Berry of the Dallas field research laboratories of Magnolia Petroleum Co. have concurrently reached similar conclusions from their independently conducted studies of wells in that area. This paper is not intended to detract from their position as pioneers in this field.

References

1. R. A. Peterson, W. R. Fillippone and F. B. Coker, "The Synthesis of Seismograms from Well Log Data," Geophysics, Vol. XX, No. 3, July 1955.
2. G. C. Summers and R. A. Broding, "Continuous Velocity Logging," Geophysics, Vol. XVII, No. 3, October 1952.
3. M. R. J. Wyllie, A. R. Gregory, L. W. Gardner, "Elastic Wave Velocities in Heterogeneous and Porous Media," Geophysics, Vol. XXI, No. 1, January 1956.
4. H. G. Doll, "The Microlaterolog," Jour. Pet. Tech., Vol. V, No. 1, January 1953.
5. A. B. Wood, "A Textbook of Sound," 2nd Edition 1941, Bell.
6. W. G. Hicks, J. E. Berry, "Application of Continuous Velocity Logs to Determination of Fluid Saturation of Reservoir Rocks." To be published soon in Geophysics.

Dowell engineers use Retarded Acid to provide maximum penetration and increased drainage area.

Retarded Acid bites deep into pay

Regular acids often become spent near the well bore in fast-reacting vugular or fractured limestone. Retarded Acid, however, has a special additive that delays its punch—allows it to penetrate deep into the pay before becoming spent. This helps you reach production that might otherwise remain trapped far from the well bore.

Now Dowell research offers you more than one kind of Retarded Acid. A new development uses the Acid Petrofrac* emulsion as the treating solution. The right kind for your well depends on formation conditions. Because of its high acid content, retarded acid action, low-fluid-loss and silicate-control properties, Dowell engineers may recommend this use of the Acid Petrofrac emulsion to you.

Let a Dowell engineer examine your well. He's an expert at prescribing the right treatment. And, too, your Dowell engineer has at his disposal the widest variety of services and treating materials in the oil fields.

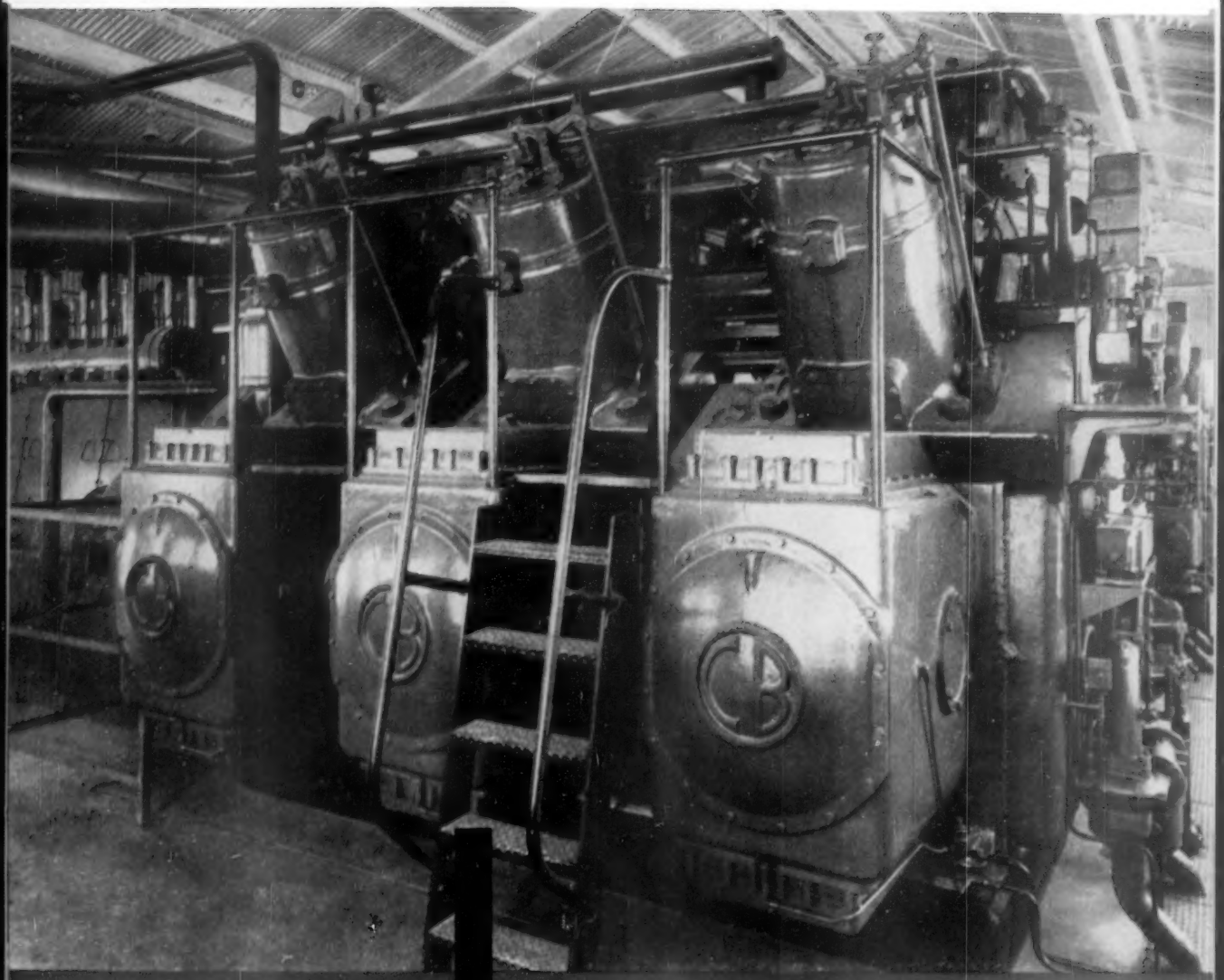
For more information, or service, call any of the 165 Dowell offices in the United States and Canada; in Venezuela, contact United Oilwell Service. Or write to Dowell Incorporated, Tulsa 1, Oklahoma, Dept. K-11.

*Service Mark of Dowell Incorporated

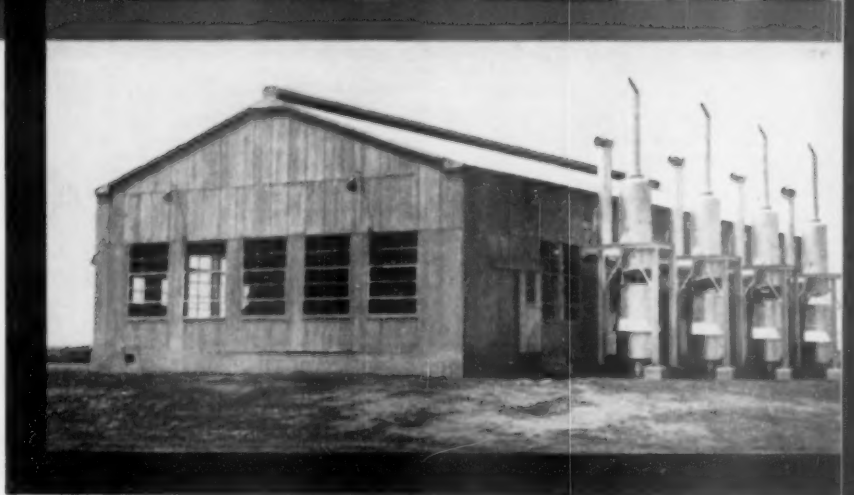
services for the oil industry

DOWELL

A SERVICE SUBSIDIARY OF THE DOW CHEMICAL COMPANY



Line-up of 6-cylinder Cooper-Bessemer V-angles in one of the pumping stations serving a large water-flooding recovery project.



A typical exterior view of one of the pumping stations.

In the foreground are 4-cylinder V-angles used for distribution. Six cylinder V-angles can be seen in the background.

GAS • DIESEL • GAS-DIESEL ENGINES

New York Washington, D. C. Bradford, Pa.

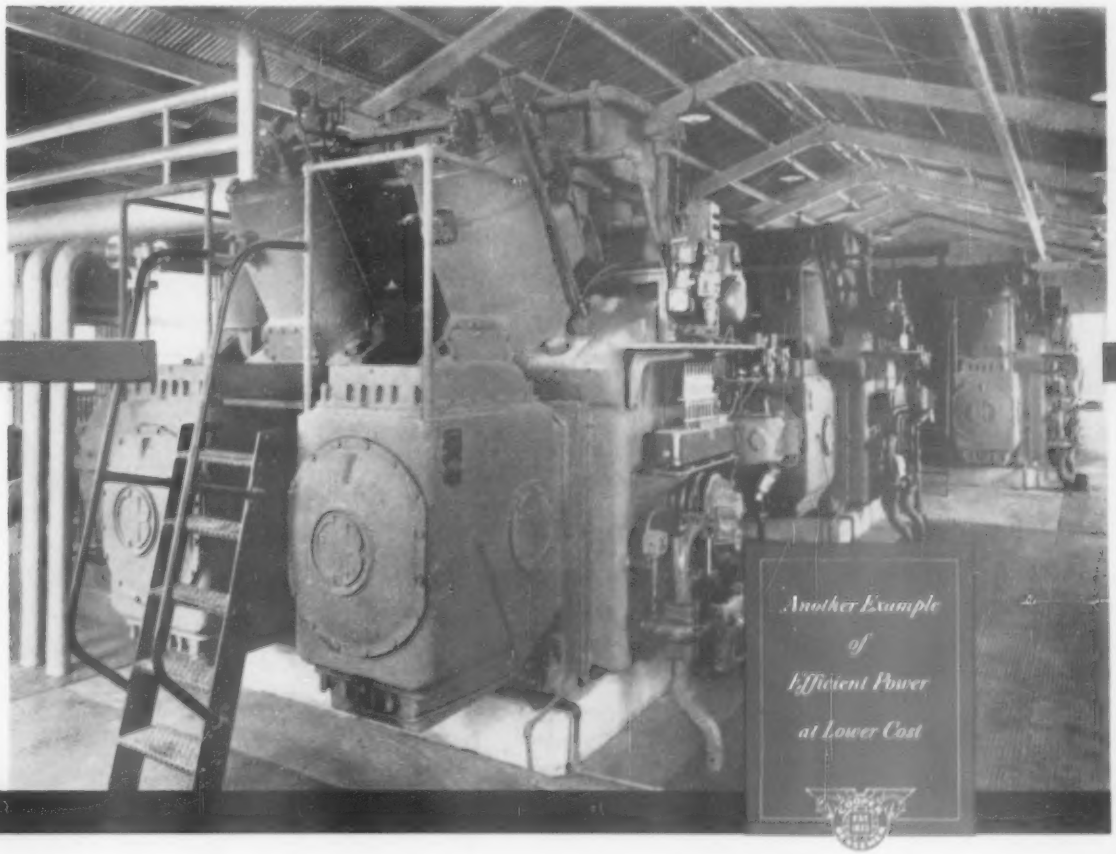
San Francisco, Cal. Houston, Dallas, Greggton, Pampa and Odessa, Texas Seattle, Wash.

How COOPER-BESSEMER V-ANGLES
help collect a PLUS bonus...in oil

● In most any important project requiring reliable pumping service, you're more than apt to find Cooper-Bessemer V-angles on the job . . . favored because they have so thoroughly proved their smooth performance, economy and low maintenance.

For example, a huge water flood project, expected to produce many millions of bonus barrels of oil, recently got underway in a major field. Twelve 6-cylinder Cooper-Bessemer V-angles have been installed for high pressure service. Two additional Cooper-Bessemer 4-cylinder V-angles, are handling low pressure distribution.

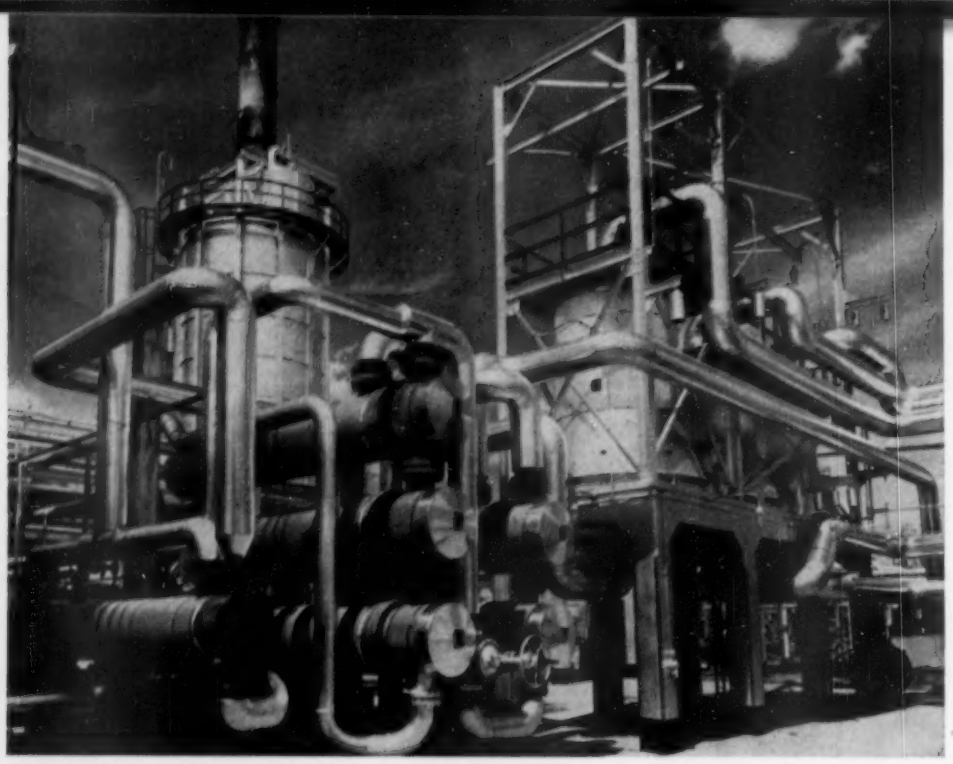
Besides outstanding performance, Cooper-Bessemer V-angles offer exceptional interchangeability of parts —a decided and welcome advantage in any large operation. Add it *all* up and it means unmatched return from every dollar invested in Cooper-Bessemers. Let us help you work out your future plans.



by **Cooper-Bessemer**

MOUNT VERNON, OHIO AND GROVE CITY, PENNA.

Tulsa Shreveport St. Louis Los Angeles Chicago



REXFORMING REACTORS at Cosden's Big Spring, Tex., refinery are at right. Heat exchangers for the unit are at left.

New Cosden Unit Makes 104 Octane

Product yield of 79 liquid volume per cent at this octane predicted for the new Rexformer

THE 3,870-bbl. per stream day U.O.P. Rexforming unit at Cosden Petroleum Corp.'s Big Spring, Tex., refinery —the first to be built new from the ground up—already has made a gasoline product testing over 104 octane, leaded.

This superfuel was obtained from the processing of a fresh feed consisting predominantly of West Texas straight-run naphtha and a depentanized natural gasoline, along with small amounts of other refinery streams.

Test runs of the unit have not been completed at the present time. Universal Oil Products Co., designer of the unit, predicts that product yield will be 79 liquid volume per cent at this octane level.

Composite feed . . . The fresh feed is a composite of several streams prepared by a highly flexible fractionation system which also serves other refinery units, and heavy ends from the feed preparation section of an aromatic producing Platformer.

The straightrun naptha portion derived from sour crude oil also has been subjected to Unifining in order to remove undesirable contaminants. Fresh feed composition, therefore, should not be taken as "typical" of West Texas naphthas.

The feed to the reactor section represents a mixture of fresh feed with recycle raffinate. When the Cosden refinery is producing jet fuel, the reactor feed will contain practically no raffinate. A correspondingly greater fresh-feed capacity will then exist, however.

The unit supplements the existing Platforming - Udex combination (now designated in this refinery as the BTX plant) which is now producing 20,000,000 gals. per year of nitration-grade aromatic chemicals. The Rexforming unit was constructed by Procon, Inc.

Cosden also has recently placed on stream a U.O.P. Unifining unit, constructed by the refinery staff, which has a capacity of 2,100 bbl. per stream day. It will be employed to remove undesirable contaminants from one of the available straightrun-gasoline stocks which, under the current operating scheme, will form a part of the total fresh feed to Rexforming.

The Rexformer will be used to produce high-octane stocks for blending into aviation gasoline and premium motor fuel and, when desired, to produce a high-quality component of jet fuel. It has been designed to produce a minimum of 98-research-octane-number unleaded product corresponding to approximately 102.5 on the Wiese octane-scale extension when leaded.

The BTX plant now will be used exclusively in the synthesis of benzene, toluene, and xylene from petroleum hydrocarbons. The Udex unit will separate these into individual aromatics of high purity. Formerly, the Platformer was operated under a blocked-out scheme to alternately produce high-octane-motor-fuel blending stocks, and high-purity aromatic chemicals.

Fractionation system . . . The new fractionation system supplements existing fractionation equipment associated with the various other processing units

What intangible difference in bits cuts most from your cost per hole?

Hawthorne field service engineers are constantly providing that valuable *experienced service* intangible which money alone can't buy . . . continuing field demonstration of the right "Blue Demon" Bits, at the right time and place, for your specific equipment and local drilling conditions. It's offered day after day, on thousands of field service calls, at no additional service cost to you.

Covering more than 300,000 miles of exploration area per year, carrying a complete assortment of "Blue Demon" Bits for every equipment and drilling requirement, Hawthorne field service engineers can start you off right in any drilling area. By proper coordination of all tangible factors involved . . . weight of rig, drill string connection, size of pump, size of powder, gravel, sandstone, limestone, sticky shale or clay . . . you eliminate the cost of time-consuming trial and error.

Such coordination of bits to your specific requirements, right on the drill . . . available only from Hawthorne field service engineers . . . costs you nothing *unless* it's not used . . . and CAN save you plenty when measuring the costs of a hole.

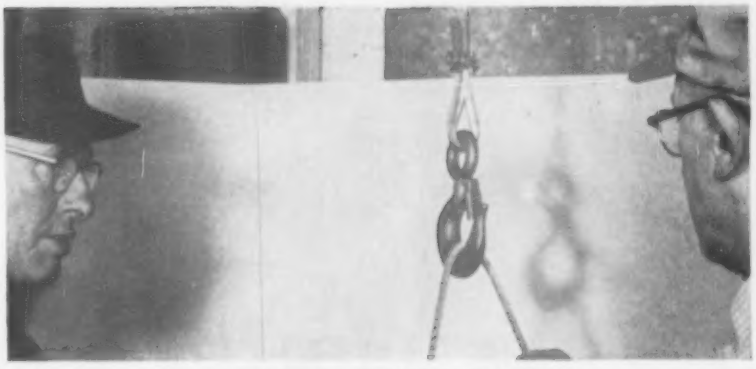
CALL YOUR HAWTHORNE FIELD SERVICE MAN FOR A FIELD DEMONSTRATION

WRITE FOR ILLUSTRATED CATALOG.

HERB J. HAWTHORNE INC.

P. O. BOX 7366 • HOUSTON 8, TEXAS

Cable Address: HAWBIT



LOADS STAY PUT!

Anyway you handle it—rough or easy—your load can't come off the hook when your crane or hoist is equipped with a Laughlin Safety Hook! When the load is set down, your sling or ring won't slip off the hook until you release it! Designed to strict specifications, the hook is drop forged and heat treated. The fool-proof latch mechanism that maintains maximum throat width is made of long life stainless steel—it'll never rust, never jam!

Non-Sparking Safety Hooks are also available for your hazardous atmosphere applications. Your distributor can give you the complete story.

TAKE IT (UP) EASY

Big hex ends of Laughlin Turnbuckles make them easy, fast and safe to take up with a standard wrench. Exclusive Laughlin eye design takes the ear of a shackle one size smaller, yet is stronger than conventional eyes because it conforms more closely to the line of pull. This same design feature also makes it easier to attach thimbles and other fittings. You can get Laughlin Drop Forged Turnbuckles in any combination of hooks, eyes and jaws in a complete range of sizes.

You'll find Laughlin fittings—the world's most complete line of fittings for chain or wire rope—fully described in the catalog available from your nearby distributor or from the Crosby-Laughlin Division.

SAFETY IS NO SECRET

You're free from worry, your workers free from danger when Crosby "Load-Rated" Crane Blocks are part of your rigging. There's no chance to overload the block by mistake because the load capacity is plainly visible on the side plate! The rated capacity *can't* be a secret when it's in sight! Workers all over the nation are protected by Crosby "Load-Rated" Blocks—are yours?

NEED A SLING FAST?

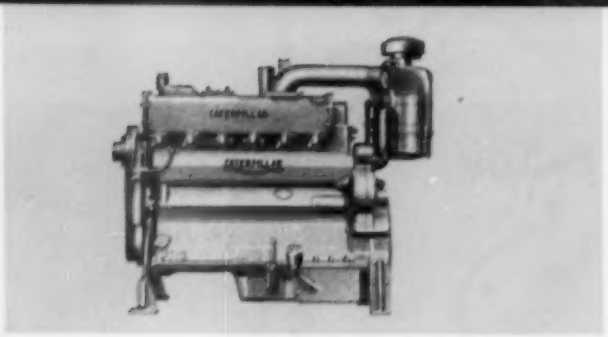
Time-consuming, expensive welding or blacksmithing is no longer necessary when coupling chains to fittings. You can make slings in minutes at lowest cost by using Laughlin's heat-treated Double Clevis Links. They'll couple ¼" to ½" standard and alloy chains to rings, end and sling links, eye hooks, pad eyes, and other fittings.

Stocked and sold by leading distributors everywhere

CROSBY-LAUGHLIN *Division*

American Hoist and Derrick Company

FORT WAYNE 1, INDIANA



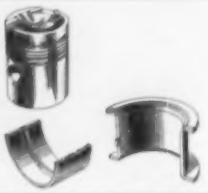
A QUARTER CENTURY OF

A CATERPILLAR FIRST
—the "Hi-Electro" hardened cylinder liner

A CATERPILLAR FIRST
—the chemically conditioned cylinder liner

A CATERPILLAR FIRST
—the stainless-steel piston protector

A CATERPILLAR FIRST
—the steel-backed aluminum bearing



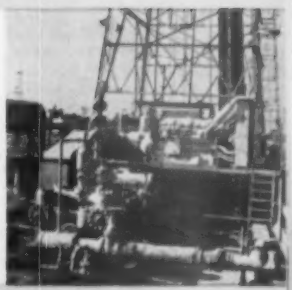
A quarter of a century ago, Caterpillar created mobile diesel power. For the first time, the power of the diesel engine was unleashed from its bulky foundations and put to work in the field—compact, economical. Here was diesel power of simple design, with no need for experts to operate and maintain. Here was diesel power with the lugging ability to knuckle down to the tough jobs.

The introduction of mobile diesel power was a tremendous advance in many fields. It provided efficient diesel power for tractors, motor graders, earthmoving equipment . . . for the work boat, the gin, the locomotive, the oil rig, the municipal plant . . . for *any* application in which steady, low-cost power is crucial. And everywhere, CAT* Diesel Engines proved themselves durable and dependable. They established Caterpillar as the leader in diesel engineering.

Today, hundreds of thousands of modern heavy-duty Cat Diesels are on the job in every corner of the world. And still the research continues. Study and experiment go ahead constantly in Caterpillar laboratories. Special testing machines help point the way toward new advances. Manufacturing techniques improve, too, in the world's largest diesel engine factory—where the quality of workmanship is the standard for the industry.

A modern world must have modern power—more and more of it. It is coming, in ever increasing quantity, from the production lines of Caterpillar, the leader.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.



CATERPILLAR*

*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

DIESEL POWER FOR PROGRESS

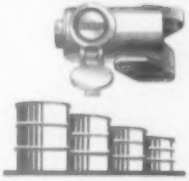
DIESEL LEADERSHIP

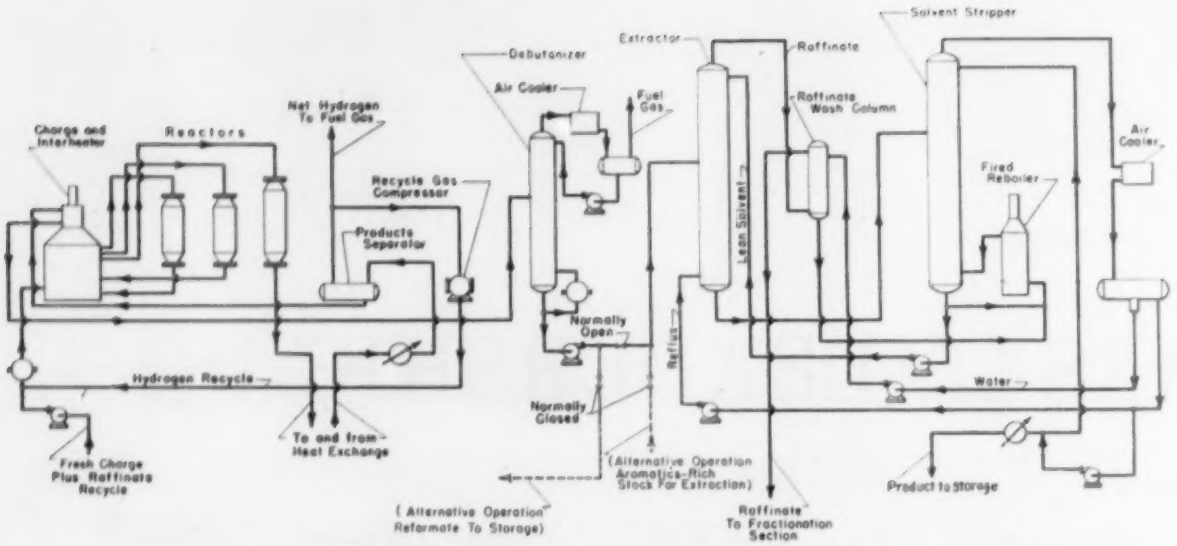
A CATERPILLAR FIRST
—interchangeable, adjustment-free fuel injection equipment

A CATERPILLAR FIRST
—the capsule-type injection valve

A CATERPILLAR FIRST
—the service meter

A CATERPILLAR FIRST
—superior lubricants (detergent oils)





PROCESS FLOW DIAGRAM for Cosden's Rexforming unit. Fig. 1.

in the Cosden refinery. One of its principal duties is the production of suitable feed for the new Rexformer from a straightrun naphtha and a 14-lb. natural gasoline. It also depentanizes the raffinate from the solvent extraction section of the Rexformer.

Additional functions of the fractionation system are the production of butane, iso and n-pentane products, and the preparation of an increment of the charge stock for the BTX plant. This latter material may be predominantly C_6 through C_8 hydrocarbons, C_7-C_8 hydrocarbons, or only C_8 hydrocarbons, depending on conditions chosen for the system.

Flow Scheme

Fig. 1 is a schematic flow diagram of the Rexforming unit. The catalytic reforming section of the Rexformer consists of a heater containing three separate coils for charge and interheat service, plus a debutanizer preheat coil in the convection section; three fixed-bed reactors containing Platforming catalyst; a product separator, and a debutanizer.

Auxiliaries include recycle hydrogen compressors, pumps, and the like. The overhead product condenser on the debutanizer, uses air rather than water.

It will be noted at this point in the flow sheet that an alternative operation is indicated for future incorporation into the operating scheme. Then, if desired, the Rexformer may be operated as a Platformer by diverting the debutanized reactor product to storage. This would permit charging an entirely different stock to the solvent extraction section for the production of an aromatic concentrate.

The paraffinic raffinate resulting from solvent extraction then, in either case, could be disposed of as a jet-fuel blending component of high quality, or utilized as part of the charge to the catalytic section.

The remainder of this discussion will describe the operation of the unit as a Rexformer.

Extraction . . . The debutanized reactor effluent is charged to a liquid-liquid extraction column containing trays of special design, where it meets in countercurrent flow a descending stream of the glycol-water solvent. The rich solvent is refluxed with a small stream of product before leaving the tower to knock back any low-octane paraffinic hydrocarbons which might have penetrated to this point in the column.

The overhead product of the extractor, the raffinate, is predominately paraffinic in nature. The extraction conditions are selected so that, in general, the high-boiling, low-octane hydrocarbons are concentrated in this stream. These materials, while low in antiknock quality, are the very paraffins which are particularly susceptible to conversion to aromatics and therefore are continuously recycled to the catalytic reactor section.

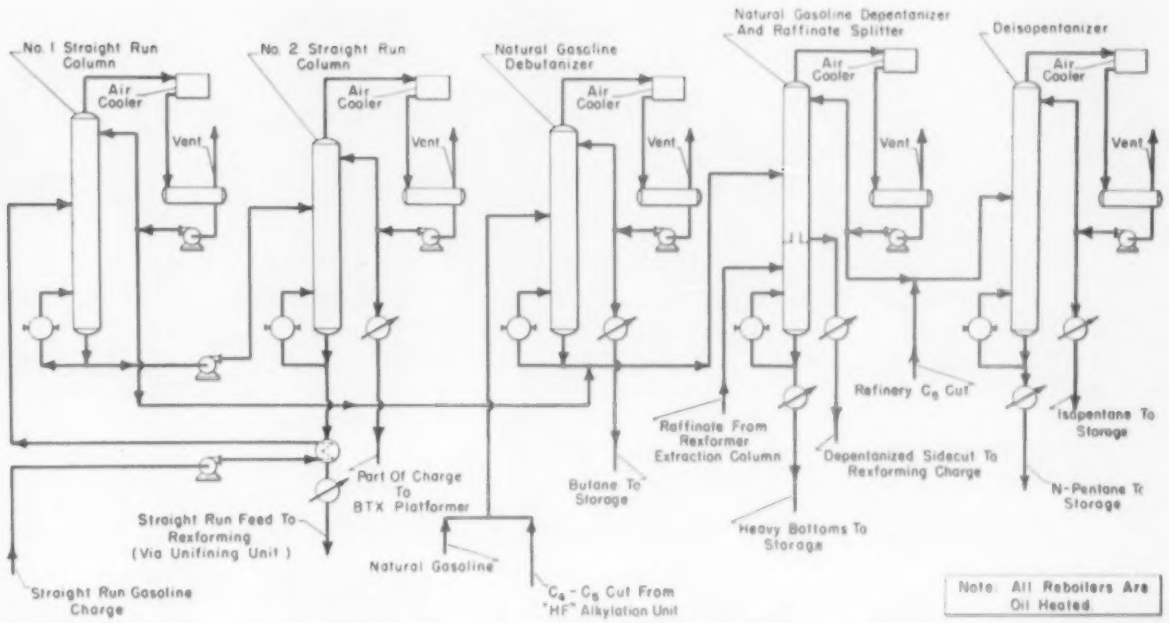
Alternatively, however, their highly paraffinic nature makes them desirable also as high-quality components of jet fuel, and thus the Cosden operating scheme has been designed to segregate this material when desired.

The raffinate may contain a small amount of glycol solvent. Therefore a

TABLE 1—INSPECTIONS OF CHARGE TO REXFORMING AND PRODUCT QUALITY

	Fresh Feed to Rexformer (Design feed)	Rexforming Reactor Charge Fresh Feed	Rexformate
Gravity, °A.P.I.	55.1	56.4	43.2
A.S.T.M. distillation			
I.B.P.	182	168	149
10 per cent	207	184	184
30 per cent	228	214	——
50 per cent	260	244	258
70 per cent	296	286	——
90 per cent	322	328	338
E.P.	379	390	394
Sulfur, wt. per cent	*0.02	0.019	
Basic nitrogen, p.p.m.	(1		
Arsenic, p.p.b.	(1		
Hydrocarbon types			
Paraffins	49.2	54.2	
Olefins	0	0	
Naphthenes	41.9	36.1	
Aromatics	8.9	9.7	64.2
F-1 Octane, clear	55.0	52.5	98.2
+ 3cc. TEL/gal.	74.6	75.0	†103.4

*Maximum total sulfur. †Wiese octane scale extension.


No. 1 Straight Run Column
No. 2 Straight Run Column
Natural Gasoline Debutanizer
Natural Gasoline Depentanizer And Raffinate Splitter
Deisopentanizer
Air Cooler
Vent
Refinery C_6 Cut
Isopentane To Storage
N-Pentane To Storage
Raffinate From Rexformer Extraction Column
Depentanized Sidecut To Rexforming Charge
Butane To Storage
Part Of Charge To BTX Platformer
Straight Run Feed To Rexforming (Via Unifining Unit)
Natural Gasoline
Heavy Bottoms To Storage
Straight Run Gasoline Charge
C_5 - C_8 Cut From "HF" Alkylation Unit
Note: All Reboilers Are Oil Heated

FRACTIONATION UNIT used for preparing charge stocks for Rexformer and BTX Platformer. Components for the refinery gasoline pool are also produced here. Fig. 2.

water wash is provided for this stream, the resultant diluting of the glycol being sufficient to spring it from the raffinate.

Solvent stripper . . . The rich solvent stream from the bottom of the extraction column is stripped of hydrocarbons in the solvent stripper. Overhead from the column is gasoline product. The bottoms stream, which is returned to the extractor is of the controlled composition required for the desired solvent action in the extraction column.

Excess water in the charge to the stripper is carried overhead with the hydrocarbons, is separated in a receiver having a water leg, and is continually recycled as washing agent in the raffinate wash column. The wash water carrying the recovered glycol enters the stripper via the inlet stream to reboiler.

Air cooling is used in the stripper overhead condenser. Subcooling of the hydrocarbon product to storage is obtained in a shell-and-tube condenser against water.

The operating flow provides the essential clues to Rexforming operation and the differences between it and the older Platforming and Udex processes from which it was developed.

Only moderately severe reforming conditions are employed in Rexforming since it is not necessary to compensate for the equilibria-limiting aromatics formation which develop in once-through Platforming to high-octane levels.

The unreacted paraffins in the reactor effluent are continuously recycled in Rexforming, whereas conversion must be much more complete in the essentially single-pass operation of Platforming.

Another difference is that reactor conditions in Rexforming are set to produce the desired amount of paraffinic raffinate. In Platforming, reaction conditions are determined by the quality of Platformate desired. In Rexforming, extractor conditions determine product quality; reactor conditions therefore may be mild.

Fractionation Unit

Cosden's new fractionation unit not only serves as a feed-preparation section for the Rexformer but has other important functions in the operating scheme of the Cosden refinery. It also contains provisions for the future, when the refinery management may find it desirable to isomerize pentane and, conceivably, hexane.

An n-pentane stream is recovered now in this unit. Another column, for which space has been left in the plot plan, is all that will be necessary to additionally produce separate normal and isohexane streams.

Flexible unit . . . The present unit is designed to be unusually flexible in its capabilities and is shown schematically in Fig. 2. It charges to its current five columns such diverse streams as debutanized straightrun gasoline, 14-lb. natural gasoline, stabilizer overhead from the HF alkylation unit, a C_5 stream from other light-ends-recovery facilities as well as the paraffinic raffinate from the Rexforming unit.

From these it produces butane, normal and isopentane, part of the straight-run fresh feed to Rexforming along with depentanized raffinate recycle, and a small quantity of heavy bottoms which may be used in a variety of ways.

Straightrun gasoline from No. 2 crude-distillation unit is charged to the first column which, in "normal" flow, acts as a depentanizer. (It can be set to dehexanize.) The bottom product is feed to the No. 2 straightrun column which is operated to provide the increment of desired C_6 to C_8 feed for the BTX plant.

The bottom product from this column, which contains sulfur and other contaminants undesirable in further processing, then is fed to the Unifining unit for purification, after which it becomes part of the feed to Rexforming. The C_5 overhead from the No. 1 column is fed to the natural gasoline depentanizer.

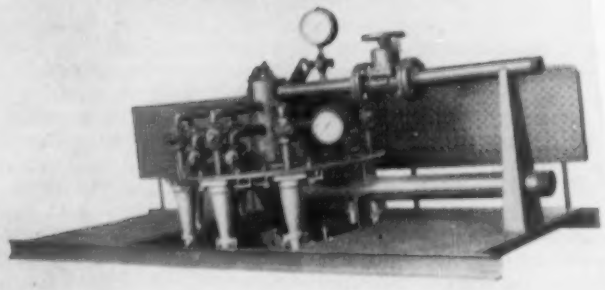
Debutanizer . . . The natural-gasoline debutanizer derives the major portion of its charge from 14-lb. natural gasoline purchased as an outside raw material. The natural-gasoline depentanizer is a double column, the lower section functioning as a raffinate splitter in order to depentanize this recycle stream to the Rexformer.

Depentanized natural gasoline is taken as a side cut directly to Rexforming charge, carrying with it the raffinate recycle. The heavy ends from these charge stocks are taken as a bottom product to storage.

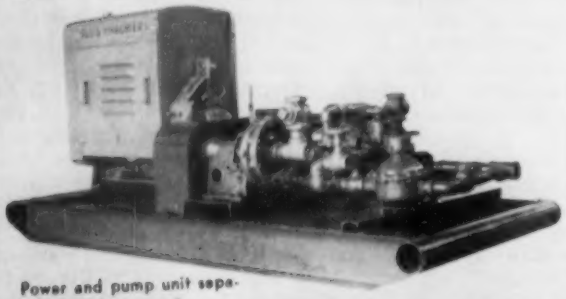
CHEROKEE *Cyclone*

RECLAIMS BARITE

NOW AVAILABLE



Liquid Cyclone unit with no moving parts. Catwalk in raised position.



Power and pump unit separately skid mounted.

- Will separate out excess clay solids
- Reduces mud maintenance costs
- High capacity
- Minimizes high temperature solidification
- Unique multiple Cyclone manifolding
- No moving parts on Cyclone unit
- Power and Cyclone units separately skid mounted for flexibility
- Lightweight and sturdy
- Easily installed and serviced
- Low rental cost

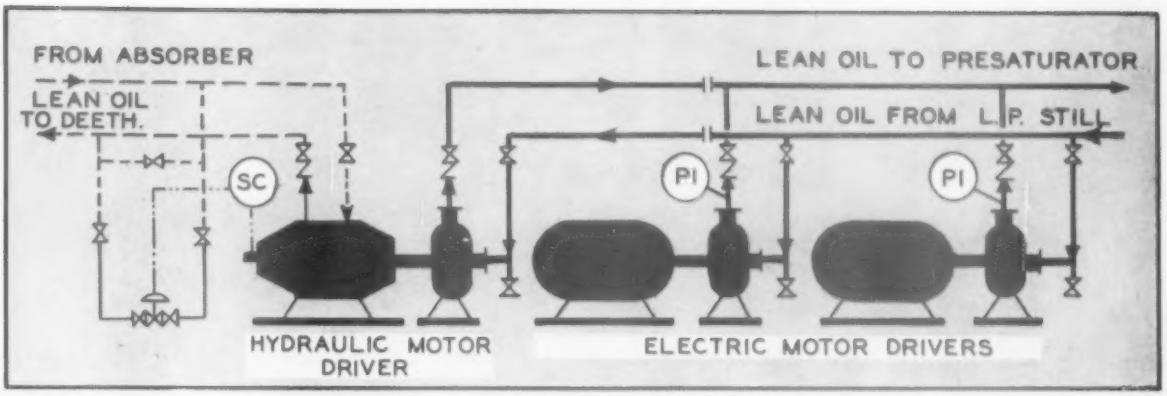
Users save hundreds of dollars a day!

For leasing arrangements and further information contact:

CHEROKEE LABORATORIES, Inc.

HOME OFFICE AND MANUFACTURING PLANT IN TULSA, OKLAHOMA

Branches: Midland, Beaumont, Corpus Christi, Oklahoma City, New Orleans, Lafayette, La., Casper



CENTRIFUGAL TYPE of hydraulic driver showing method of control. Fig. 1.

A Look at Hydraulic Rich-Oil Motors

. . . and their application to various oil operations

by B. J. Thompson

A FLUID or hydraulic motor is a prime mover run by oil or other liquid fluids under pressure by taking a pressure drop through the power unit. It is well to keep in mind that any unit that can be used as a pump also may be used as a motor or hydraulic power unit by flowing a stream in the reverse direction to pumping service.

Several of the more common hydraulic unit types are:

1. Centrifugal
2. Gear
3. Reciprocating piston
4. Rotary piston
5. Screw
6. Vane
7. Vane-rotor combination with timing device.

Applications of hydraulic power which are common today include water turbines to drive electrical generators, pumps, and blowers. Hydraulic-oil systems are employed for lifting devices, various aircraft application, automotive application, and heavy industrial-equipment power source.

Recognition should be given to the satisfactory application of variable-speed hydraulic drives in gas-compressor stations. The hydraulic transmission may consist of a pump driven from the compressor fly wheel to furnish power oil to a hydraulic motor directly connected to a fan used for aerial cooling of lube oil, jacket water, or gas. A second type of transmission system may employ power oil direct from the main gas-engine lube-oil pump.

Various makes of the positive-displacement-design hydraulic motors have proved satisfactory in this service over a period of several years in operation. Accurate control of jacket-water temperature can be effected by using a temperature controller in conjunction with the variable-speed fan. The automatic control of jacket-water temperature within a very narrow range is particularly advantageous in the operation of remotely located unattended compressor stations.

Rich-Oil Turbine

A specific and unusual application of hydraulic power of current interest is to recover power available when a liquid stream is reduced in pressure. The special application is known as a "rich-oil turbine or motor." This recent development in the application of hydraulic power has occurred within the past decade.

Many natural-gas-processing plants employ absorption oil at an elevated pressure to extract light-hydrocarbon fractions from natural gas. Absorber operating pressures ranging from 500 to 2,000 psi. are common. A large number of the absorption plants operate in the 700 to 800-psi. range. The rich-oil stream leaving the bottom of the absorber is quite commonly reduced in pressure through a differential of 250 to 550 psi. If several hundred gallons of oil per minute are flowing through the system a substantial horsepower loss is represented by this pressure letdown through a conventional diaphragm-operated control valve.

Recover horsepower . . . Studies and investigations have been conducted to determine a practical way to recover, for useful consumption, the horsepower normally wasted by the pressure-letdown step in the process. Several hydraulic power units have been installed within the past 5 years to recover a portion of the rich-oil-stream power for use to pump another process stream to some unit adjacent to the oil absorber. The author has knowledge of five different makes of hydraulic power units which have been applied in the rich-oil system. Some manufacturers have applied centrifugal units while others use rotary-piston, rotor-vane, and screw type of power units. These units represent two basic types referred to as (1) centrifugal or turbine design and (2) positive-displacement design. Installed horsepower per unit ranges from 15 to 225. Units of each design do have some application advantages and limitations which will be discussed further in this paper.

Types of units . . . Some manufacturers employ a design of positive-displacement, close-clearance units with many moving parts while other designs employ relatively few moving parts. A

Author is superintendent, chemical service, Warren Petroleum Corp. at Tulsa. Paper presented at A.S.M.E. Petroleum-Engineering Conference, Dallas.

FIELD PROCESSING

ON THE NOSE

PRECISE ALLOY MIX GIVES *extra life* TO CHASE® ANTIMONIAL ADMIRALTY HEAT EXCHANGER TUBES

Strange that such a simple little thing as weighing could add years of life to a heat exchanger tube. Yet this careful weighing, plus extra care in manufacture, is why Chase Antimonial Admiralty Heat Exchanger Tubes *do* last longer!

Thanks to this weighing process, Chase Antimonial Admiralty Heat Exchanger Tubes contain *exactly* the right combination of metals to resist the ravages of dezincification. As a result, Chase Antimonial Admiralty Heat Exchanger Tubes mean lower operating costs, fewer breakdowns, more time between tube replacements!

Next time you plan a new installation, or replace heat exchanger tubes, install Chase Antimonial Admiralty. Enjoy extra years of service!

CHASE WAREHOUSE STOCKS: Beaumont,* Houston,* Los Angeles, New Orleans, Tulsa**

*Handled by Standard Brass & Mfg. Co. **Handled by Vinson Supply Co.

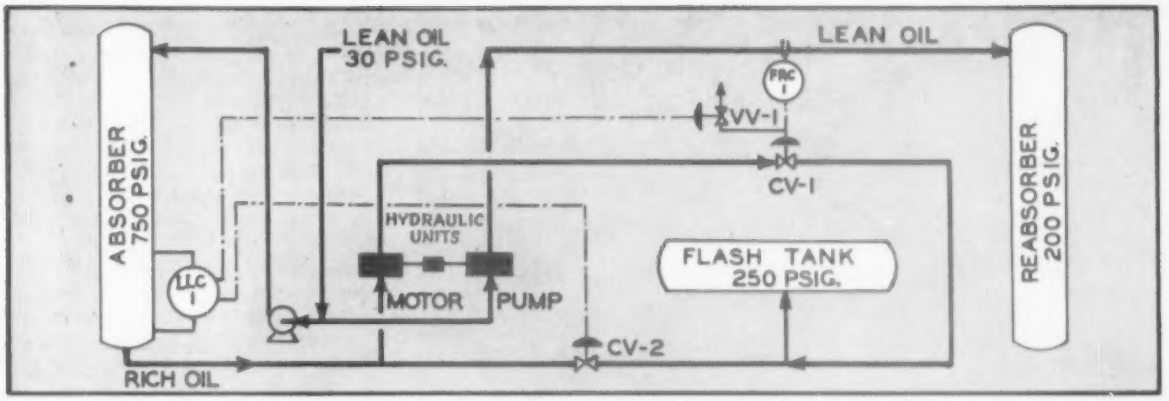
Chase®

BRASS & COPPER CO.

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

The Nation's Headquarters for Brass & Copper

Atlanta, Baltimore, Boston, Charlotte, Chicago, Cincinnati, Cleveland, Dallas, Darrow, Detroit, Grand Rapids, Houston, Indianapolis, Kansas City, Mo., Los Angeles, Milwaukee, Minneapolis, Newark, New Orleans, New York, Philadelphia, Pittsburgh, Providence, Rochester, St. Louis, San Francisco, Seattle, Waterbury



DISPLACEMENT TYPE of hydraulic driver (motor) and pump control scheme. Fig. 2.

unit of centrifugal design is less sensitive to nonlubricating properties of power fluid and foreign materials entering the fluid system than is the experience with close-clearance units. The positive-displacement type of units will generally be lighter weight and take some less space than is required for centrifugal units. One positive type of unit has been in rich-oil service 4½ years. Some of the centrifugal units (100 hp.) have been in operation approximately 2 years. One of the larger (225-hp.) centrifugal-unit installations has been in operation several months. All of these units have given satisfactory performance.

Control Systems

Several methods of power-unit control have been used successfully. Most of the control schemes employed are relatively simple.

Speed control . . . Fig. 1 shows schematically the centrifugal unit which has operated for 2 years employing a flow controller for output demand by the driven unit in combination with speed control mounted directly on the shaft of the hydraulic-turbine driver unit. The speed control is a generator type of tachometer which transmits speed of the hydraulic unit to a flow controller.

If the speed developed is too high the flow controller, through the electropneumatic controller, reduces the speed of the unit by directing less rich oil through the hydraulic-turbine power unit. Similar speed-control arrangements have been employed for the positive-displacement type of power units.

It is believed the electropneumatic control unit is unnecessary since a conventional pneumatic flow controller will carry out the essential functions of transmitting a reduced or increased diaphragm pressure to a master control valve.

Most types of hydraulic power units can be controlled quite simply over a wide range of speed and horsepower output. Control of one of the positive-displacement type of units is accomplished with a flow-recording controller to operate the pneumatic control valve downstream of the hydraulic motor to regulate the quantity of fluid required by the power unit. The control valve is operated by a flow recording controller to regulate delivery of lean oil to a reabsorber tower.

Safety feature . . . Fig. 2 indicates schematically the foregoing control system which incorporates a safety feature. The control system utilized in this instance requires two diaphragm-operated control valves in main-line flows and one vent valve. The portion of the system including the liquid-level control LLC-1 and the diaphragm-operated control valve CV-2 is conventional and will be found in most absorption systems. Vent valve VV-1 has been added to control operations of the hydraulic power unit safely.

The theory of the combined system is that flow controller FRC-1 actuates control valve CV-1 in accordance with the power demand to pump lean oil through the reabsorber tower. Any rich oil available in excess of that quantity required for power will be bypassed automatically to the rich-oil vent tanks through control valve CV-2 as indicated by increasing level at LIC-1.

Should the oil supply to the main absorber be interrupted or should there be a high demand on the control valve CV-1 for the rich oil, resulting in a rapid lowering of the rich-oil level in the absorber, it is possible that the liquid seal at the bottom of the tower could be lost. Loss of the liquid seal could result in high-pressure gases flowing downstream into low-pressure distillation equipment. To eliminate this hazard the pilot on LIC-1 is adjusted so that when the output air pressure falls below 5 psig. the vent valve VV-1 is opened immediately. When the vent valve is opened, pressure is removed from the diaphragm of control valve CV-1, which will be automatically spring closed to prevent further flow through this system.

Efficiencies

Efficiency will vary more with speed when using centrifugal-design units. A positive-displacement unit exhibits a smooth output-torque curve and therefore high efficiency over a wide speed and load range. Efficiencies of the various basic types of hydraulic power units vary over a wide range from a low limit of zero efficiency to a reported high of approximately 80 per cent. It is rather difficult to establish a basis for determining efficiency which is sufficiently universal to permit accurate comparison and communication among various persons observing unit efficiencies.

The extreme low efficiencies occur for low-flow, low-speed conditions when employing a centrifugal unit. The optimum efficiency is obtained from a centrifugal-design unit when it operates near its design speed and flow rate. Thus, it is apparent that the centrifugal unit is not the optimum choice for applications requiring wide variations of speed and horsepower.

The centrifugal or turbine type of power units do not lend themselves efficiently to the services requiring variable speeds because of the inherent characteristics, one of which is that the hydraulic horsepower varies as the cube of the speed. On the other hand, the positive-displacement machine produces a horsepower-capability curve almost directly proportional to the speed change, which results in flexibility for such applications as fan drives where it is desirable to change the speed to compensate for ambient-air temperature changes.

Mechanical and Operating Notes

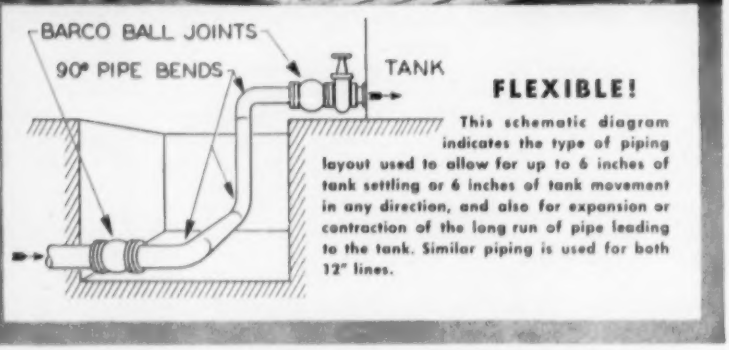
It is generally recommended that any

NEW

12" BARCO

Flexible Ball Joints

(also new 8" and 10" sizes)



FLEXIBLE!

This schematic diagram indicates the type of piping layout used to allow for up to 6 inches of tank settling or 6 inches of tank movement in any direction, and also for expansion or contraction of the long run of pipe leading to the tank. Similar piping is used for both 12" lines.

Built to Handle Big Tank Jobs!

One of the first places where twelve of Barco's new large size Flexible Ball Joints have been put to use is on three 170,000 bbl. West Coast tanks which receive crude from a new 12,000 ft. long 24" off-shore pipeline. As shown in the above photograph, each tank is connected by two 12" lines—each fitted with two 12" Barco Ball Joints. The joints provide the following advantages:

1. **Allow for tank settling or tilting. Also pipe expansion.**
2. **Isolate tanks against earthquake shock; also pump shock.**
3. **Maximum protection against Fire Hazards.**

For detailed information about new 8", 10" and 12" Barco Ball Joints, see our nearest representative or WRITE FOR NEW CATALOG 215B. Joints available in Bar-Ductile metal or steel; flanged or welding ends. 15° angular flex.

FOUNDED 1908 BARCO PRODUCTS BACKED BY EXPERIENCE

BARCO MANUFACTURING CO.

539M Hough Street • Barrington, Illinois

The Only Truly Complete Line of Flexible Ball, Swivel, Swing and Revolving Joints

In Canada: The Holden Co., Ltd., Montreal

system employing hydraulic drives be thoroughly cleaned of all extraneous materials and preferably that a strainer be installed temporarily or permanently in the inlet piping to insure that foreign materials including dirt, welding slag, pipe scale and other hard materials will not enter the hydraulic unit. This is particularly important for the close-clearance type of units.

Vibration . . . Some design and operating people have observed that the close-clearance, positive-displacement type of units may exhibit a tendency to vibrate under certain operating conditions, particularly if the rich oil is giving up by flash some of the absorbed gases. The inherent characteristics of the centrifugal-turbine type of unit are such that vibration does not occur because of the vapors present. Centrifugal units may even deliver slightly increased power output when flash gases are present with the oil system.

Installations . . . One example of the turbine type of unit in operation is a single-stage machine taking inlet rich oil at 435 psi. and discharging it at 235 psi. for an output of 175 hp. A similar unit includes three stages and takes an inlet rich-oil stream at 800 psi. and delivers the outlet stream at 250 psi. for a horsepower output of 100. Recent installations incorporate a multistage centrifugal or turbine type of unit designed to deliver 225 hp. Some designers feel that fluid flows below 200 g.p.m. result in an uneconomical machine (hydraulic power unit) particularly if it is the centrifugal or turbine type. The positive-displacement type of units could very well have economic applications at low flowing rates.

One manufacturer makes use of a separate small electric-motor drive to furnish lubrication to the centrifugal or turbine type of unit prior to loading the unit.

Two Types of Centrifugals

The design of centrifugal or turbine type of units, currently in rich-oil service, include (1) a split-case, double-end shaft operating at 3,550 r.p.m., incorporating three stages of the diffuser type equipped with guide vanes, and (2) a single-stage volute type. Continuous service for several months indicates the balanced mechanical seals can be employed satisfactorily in these units without damage to the seal as a result of hydrocarbon vapors present in the rich-oil stream. Observation of some of the centrifugal units in operation indicates that correction or allowance for revised diffuser design, as compared to the conventional centrifugal-pump impeller, can be overdone.

RESPECTED STANDARD OF QUALITY

A refinery in Texas . . . a chemical processing plant in Louisiana . . . a high-pressure power plant in New Jersey . . . a classified project in California . . . a ship at sea . . .

Common denominator: danger to personnel and equipment from fluids confined in high pressure/temperature range.

Uncommonly good judgment: use FLEXITALLIC Spiral-Wound Gaskets to insure a safe seal.

The amazing flexibility of Flexitallic Gaskets compensates for the variable stresses encountered in service . . . prevents contamination where corrosive conditions exist.

Since 1912, engineers have been designing for safety with Flexitallic, the original Spiral-Wound Gasket. It's why we at Flexitallic work conscientiously to maintain this respected standard of quality.

Each Flexitallic Gasket is designed and engineered to meet specific conditions of thermal and physical shock, corrosion, vibration, weaving and unpredictable joint stresses. Spirally-wound V-crimped plies of required metal with alternating plies of proper filler result in a resilient gasket having controlled compression characteristics like those of a precalibrated spring.

Flexitallic Gaskets are at highest efficiency when bolted up cold at a predetermined load. For all pressure-temperature ranges from vacuum to 10,000 lbs., from extreme sub-zero to 2000 F. For all standard joint assemblies. In four thicknesses for special requirements: .125", .175", .250", .285".

FLEXITALLIC GASKET CO.
8th & Bailey Sts., Camden 2, N. J.
Representatives in principal cities

Flexitallic®
SPIRAL-WOUND GASKETS

FOR PIPE FLANGES, PRESSURE VESSELS AND PROCESS EQUIPMENT

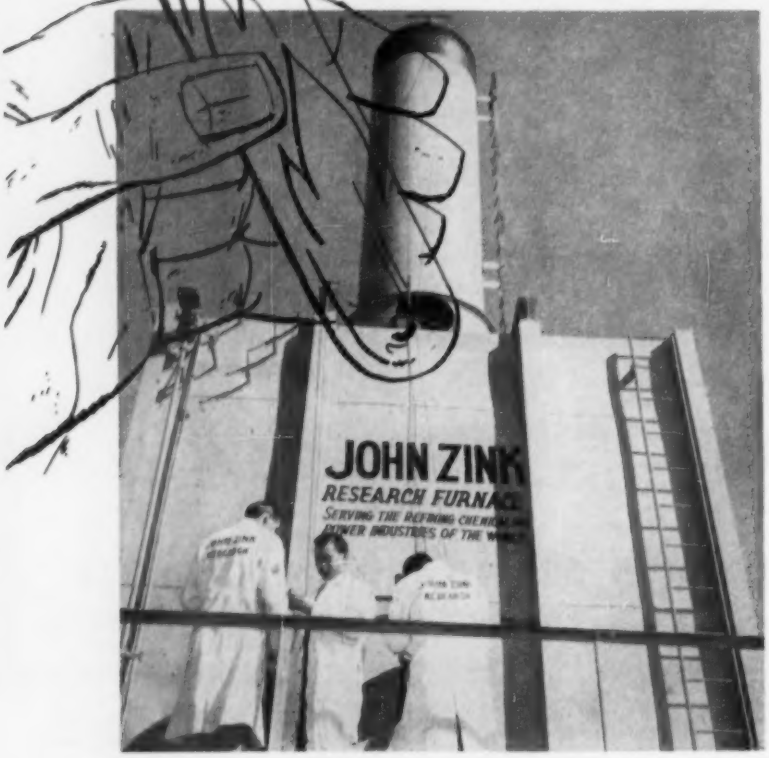
TEFLON FOR PROCESS APPLICATIONS

The ideal seal for many process applications is a Flexitallic Gasket with Teflon trapped between edges of stainless steel. Ask for folder, "Teflon in Flexitallic Gaskets."

*Flexitallic is a registered trade name. No one else can make a Flexitallic Gasket. Look for *Flexitallic Blue*—it's our exclusive blue-dyed Canadian asbestos filler.

JOHN ZINK BURNERS

. . . scientifically tested and performance rated to do the job RIGHT . . .



This research furnace affords an ideal proving ground for design changes in standard lines of burners, as well as enabling the John Zink Company to find *workable* solutions to new problems. In this way the John Zink Company can offer you special burners for your individual application . . . burners that have been *performance tested* before they reach your job site.

→ *The facilities of the John Zink research furnace are available to industry.*

WE MAKE HEAT . . . AROUND THE WORLD

If you have a specialized industrial burner problem . . . JOHN ZINK has the answer . . .

JOHN ZINK COMPANY

4401 SOUTH PEORIA TULSA 5, OKLAHOMA

Special Considerations

Several operators have been concerned with the proper point for throttling of a rich-oil stream through a power unit. In the case of the positive-displacement units which employ very close-tolerance moving parts, some have proposed that a throttling valve upstream from the power unit could possibly result in enough flash vapors to effect a nonlubricating condition serious enough to cause extreme rapid wear of bearings and other precision parts. It appeared in the operation of some of the earlier units that this condition may have been true. Minor design alterations appear to have corrected this condition to an extent that the throttling valve may be located in the upstream or downstream position. Periods as long as 16 months of continuous operation have been recorded without evidence of excessive wear, due to vapors being present.

Some operating observations indicate as much as 8 per cent additional horsepower recovered when upstream throttling had resulted in the presence of flash gases. It is also felt by several observers that a unit of centrifugal design is unlikely to suffer in efficiency if vapors are present and may well exhibit a measurable increase in delivered horsepower.

Economics

The delivered cost of various hydraulic power units, used in rich-oil service in the last 5 years, ranges from $20 to $210 per rated horsepower. The low price represents positive-displacement units in the 100 to 125-hp. size. Some small-horsepower (15 to 30) centrifugal units have cost up to $210 per rated horsepower. Another comparison is a 40-hp. displacement unit which delivered for $67 per horsepower and a 100-hp. centrifugal for $57 per rated horsepower. It is evident from the range of delivered-cost figures that each installation is a special case and requires careful economic and mechanical analysis before establishing final design.

Trial stage . . . The majority of the installations covered in this discussion are in the category of trial or proving stage. It appears reasonable to expect improved designs, decreased maintenance, and a narrowing of the investment range as more experience is gained by designers, manufacturers, and operators.

Several of the hydraulic units equipped with bearings exposed to the rich oil have required frequent bearing replacements. Improvements in bearing design and application experience have resulted in much longer continuous periods of operation.

Peak demand . . . Few, if any, precise

For these pressures and capacities	Use these combinations of Schramm Portable Air Compressors and Boosters
600 cfm @ 20 to 100 psi	
1200 cfm @ 20 to 100 psi	
900 cfm @ 500 psi	
1800 cfm @ 100 psi	
1800 cfm @ 500 psi	
1700 cfm @ 1000 psi or 1635 cfm @ 1500 psi	

Model 600 Compressor Model 1D Booster Model PPC Booster

Portable booster system...flexible as you wish

Gives any volume of air up to 1800 cfm at pressures up to 1500 psi

When you need compressed air at higher than 125 psi—for drilling oil or gas wells, or testing pipe lines—get it at lowest cost with this flexible combination of Schramm Portable Compressors and Boosters. By varying the combination of units, you get desired volumes and pressures—from 125 cfm at 100 psi up to 1800 cfm at 1500 psi.

Each of the three Model 600 Schramm Compressors shown delivers up to 600 cfm at pressures up to 125 psi. If you need more pressure, use one or two of the boosters. Two compressors (at slow speed) and one booster deliver 900 cfm at up to 500 psi. And all three compressors (running at rated speed) and both boosters give up to 1800 cfm at up to 1500 psi. You get exactly what you need for the specific job.

Compressed air drilling of oil and gas wells becomes more practical than ever with this flexible, economical system of portable units. Schramm combinations increase penetration rates by 40% to 237% over conventional rigs. Holes are cleaner and straighter. Mud cake is eliminated. Bits last up to 348% longer. Cuttings can be examined continuously. Core recovery is excellent. Cement requirements are lower. And the use of air, instead of mud, eliminates cost of water and chemical mud. Also, you have no lost-circulation problems when you drill with air.

If you have never used the Schramm method of drilling with air, your drilling costs may be as much as 50% higher than they should be. Start cutting them now; get full information on Schramm Portable Compressor-and-Booster Combinations. Free data sheet shows nine combinations available. Send for your copy and ask for full details of rotary rock drilling with Schramm Portable Compressors and Boosters. No obligation.

Schramm Portable Compressors and Boosters are easy to install. Simply wheel them into position, connect to manifold and begin drilling without further adjustment. All Schramm Boosters and Model 600 Compressors are powered by the same engine, either the International Harvester UD-1091 diesel or U-1091 gas engine. Result: fewer service parts, lowest maintenance.

Your local Schramm Dealer is listed in the Yellow Pages of your telephone directory.

Schramm, Inc.

MANUFACTURERS OF AIR COMPRESSORS

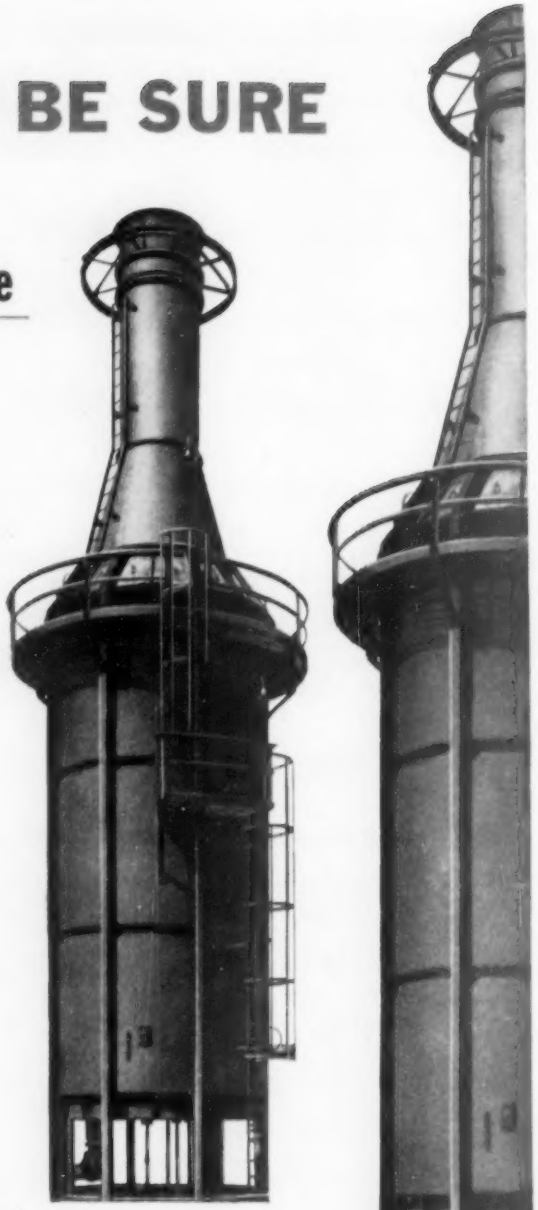
630 North Garfield Ave. West Chester, Pa.

YOU, too, CAN BE SURE

petrochem-isoflow furnaces

are most economically desirable

by any comparison



Whenever *all* the specifications and *all* the operating requirements are applied to direct-fired furnace design, you can be sure PETROCHEM-ISOFLOW FURNACES will be found most economically desirable, by any comparison.

In making comparisons it is essential to take these factors into consideration:

1—Average radiant transfer rate.
2—Maximum deviation from average radiant transfer rate.
3—Average and maximum transfer rate in convection section.
4—Maximum tube wall temperature, radiant or convection.
5—Maximum efficiency with specified excess air.
6—Controlled thermal recirculation of flue gases to provide even heat distribution throughout full length of each tube and equalized heat distribution around each tube.
7—Overload and corresponding transfer load.
8—Design to provide: structural column supports—Ladders—Platforms—Tube Removal facilities, etc.
9—Degree of assembly; of the furnace structure and of the heating surface.

When you specify PETROCHEM-ISOFLOW FURNACES... you'll be in good company. More than 1500 are now in service, performing to the complete satisfaction of their operators and usually well beyond their rated capacities.

PETROCHEM-ISOFLOW FURNACES

UNLIMITED IN SIZE . . . CAPACITY . . . DUTY

PETRO-CHEM DEVELOPMENT CO., INC. • 122 EAST 42nd St., New York 17, N. Y.

REPRESENTATIVES:

Rowson & Co., *Houston* • Wm. H. Mason Co., *Tulsa* • Lester Oberholtz, *Los Angeles* • Faville-Levally, *Chicago* • D. D. Foster, *Pittsburgh* • Turbex, *Philadelphia* • Flagg, Brackett & Durgin, *Boston* • G. M. Wallace & Co., *Denver & Salt Lake City*

International Licensees and Representatives: SETEA—S.A. Comercial, Industrial, y de Estudios Tecnicos, *Buenos Aires, Argentina* • Industrial Provesedora, *Caracas, Venezuela* • Societe Anonyme Huertey, *Paris, France* • Societe Anonyme Belge, *Liege, Belgium* • Huertey Italiana S.P.A., *Milan, Italy* • Birwelco Ltd., *Birmingham, England*

direct operating savings in terms of dollars per horsepower have been reported. This direct economic factor can be expected to receive itemized consideration within this decade as extended periods of satisfactory operation are recorded. It is significant to note that some plants, which operate rich-oil-powered units in sizes of 100 hp. or larger, make very good use of the available power to meet summer peak demands. The peak-demand problem is most evident in plants employing large aerial coolers with electric-motor fan drives. A plant requiring additional horsepower, in small enough quantity to make the installation of an extra electrical power generator impractical, could possibly use the rich-oil power source. An example could be a plant which has four 300-kw. generator units operating normally loaded and a new requirement arises for 75-kw. Adding a 75 or 300-kw. generator unit would not be a desirable choice. Power from a rich-oil source would be a likely solution for such an application.

Conclusions

It is desirable to conserve energy and to make the best possible use of available power in any industrial facility. Sufficient experience is recorded to indicate the feasibility of using rich-oil powered drivers for continuous service. Operators planning the use of hydraulic rich-oil motors will be wise to analyze each application carefully to determine the type (displacement or centrifugal) unit design best suited for the specific installation. Manufacturers of hydraulic power units can be of considerable assistance in reviewing specific service applications.

Acknowledgments

The author is indebted to the following companies for information supplied in preparation of this paper: Berry Division of Oliver Iron & Steel Corp.; De Laval Steam Turbine Co.; Rockwell Manufacturing Co.; Ingersoll-Rand Co.; Pacific Pumps, Inc.; Warren Petroleum Corp.; LaGloria Oil & Gas Co.; Acadia Corp., and Carthage Corp.

References

"Dry Distillation, Two-Still System," by R. L. Lane, The Oil and Gas Journal, Jan. 2, 1956, pp. 80-88.

"Absorption and Dry Distillation," by R. L. Lane and B. J. Thompson, Proceedings thirty-first annual convention, N.G.A.A., The Oil and Gas Journal, May 5, 1952, p. 175.

"New Developments in Design of Ringwood Plant," by B. J. Thompson, The Oil and Gas Journal, April 27, 1953, pp. 161-67.

"Hydraulic Oils and Their Application," by the staff of Sun Oil Co., Tech. Bulletin No. B-4, 1942, pp. 5-21.

"Natural Gas Conservation Project," by B. J. Thompson, Petroleum Engineer, January 1953, pp. C-5—C-12.

an ACCO product

ACCO's Great New Chain...

ACCOLOY X-WELD 125

• At last—a chain with welds as strong or stronger than the material . . . welds made with two projecting lugs that absolutely prevent kinking.

Accoloy X-Weld 125 Chains hang straight as a die. Every link is perfectly formed!

Accoloy X-Weld 125 Chain has almost countless uses: Slings, bundling, towing, boomer, general utility chains . . . It can be furnished in special analyses and heat treatments. Available in ¼", ⅜", ½", ⅝" and ¾" sizes.

Write the American Chain Division, York, Pa., for descriptive bulletin

The Secret is in the Weld!

This Accoloy X-Weld 125 link was ground and etched to show its big welded area —2½ times the size of welded area possible with other welding processes. This means more than double the security at the weld—and only X-Weld has it!

PATENT APPLIED FOR

ACCO

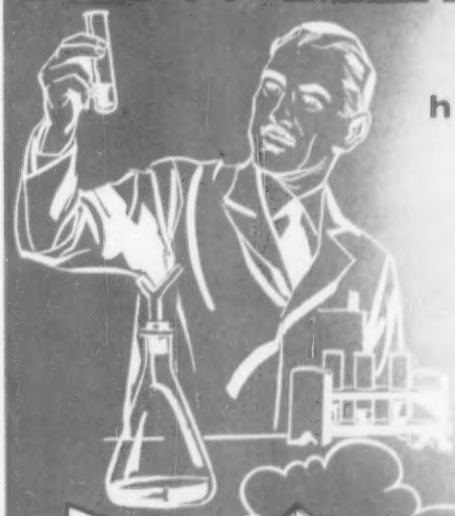
American Chain Division
AMERICAN CHAIN & CABLE

York, Pa., Atlanta, Boston, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, Portland, Ore., San Francisco, Bridgeport, Conn.

for Better Value

NEW METHODS go hand in hand

That goes for credit as well as research. You'll like our up-to-the-minute oil financing methods.



The DENVER National Bank

CORNER 17TH & CHAMPA STS. AComa 2-2661

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

Houston's BIGGEST *Bank*

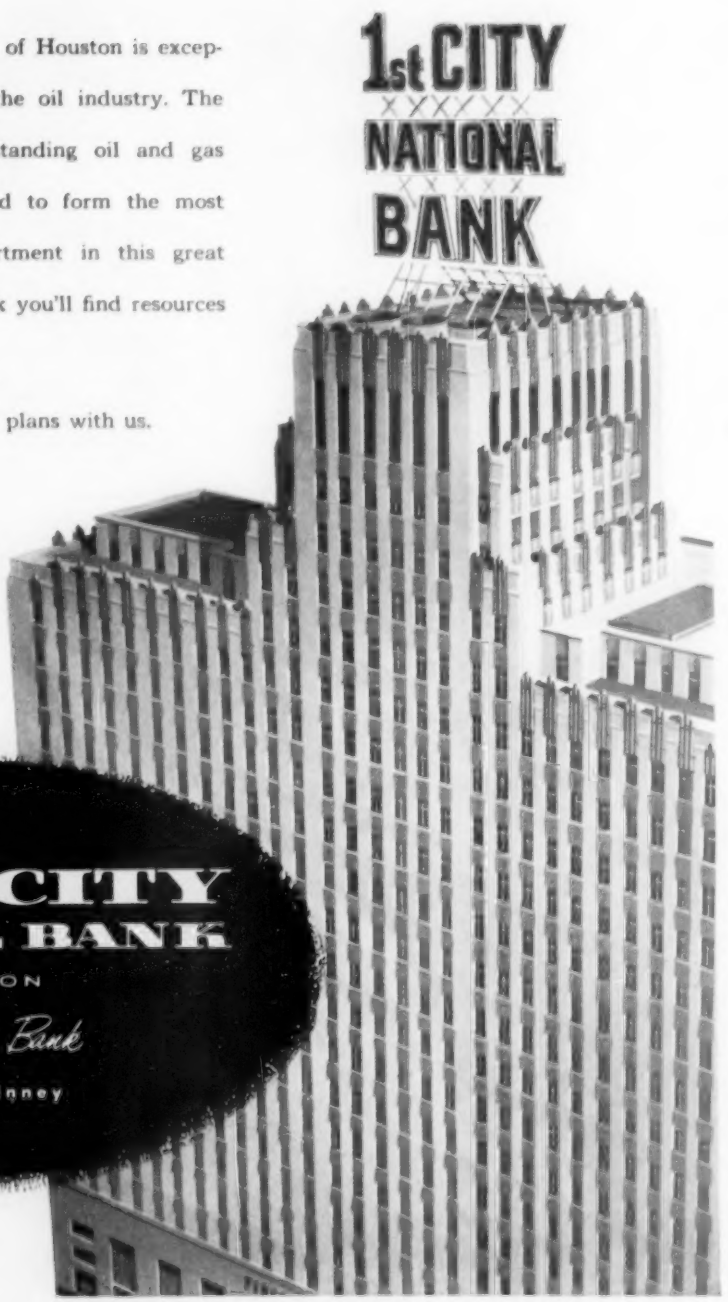
serves the Southwest's

BIGGEST INDUSTRY

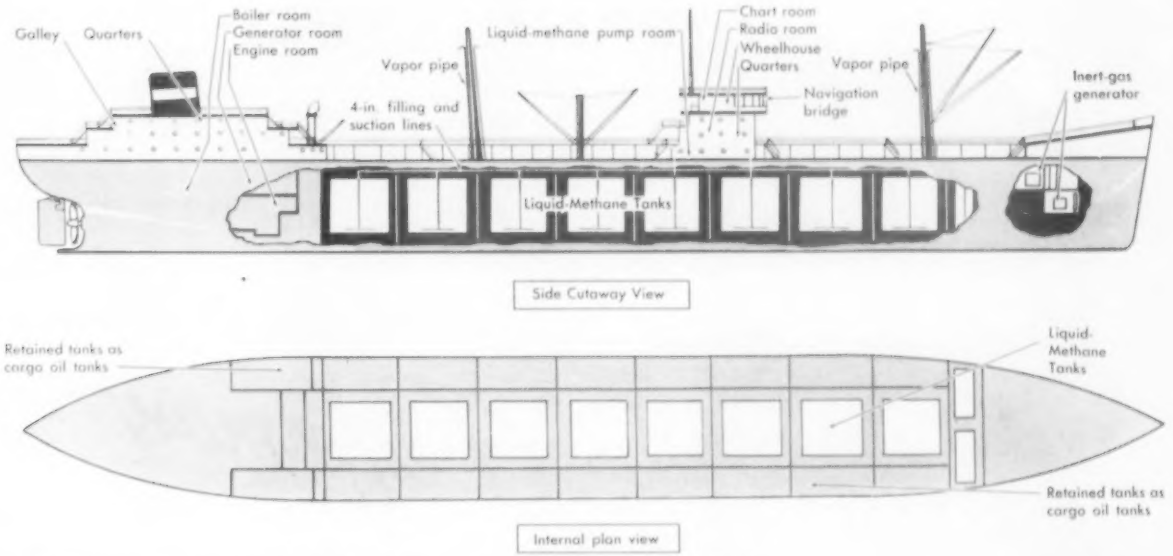
The First City National Bank of Houston is exceptionally well qualified to serve the oil industry. The facilities and staffs of two outstanding oil and gas departments have been combined to form the most complete bank petroleum department in this great petroleum center. At this *big* bank you'll find resources to meet any needs.

We invite you to discuss your plans with us.

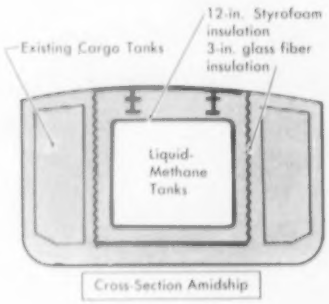
MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION



FIRST CITY
NATIONAL BANK
OF HOUSTON
Houston's Big Bank
Main and McKinney



TEN METHANE TANKS are called for in the plan for conversion of the tanker to liquefied-methane use. Stainless-steel rectangular tanks are installed in the centerline row of eight cargo oil tanks and in the two smaller forward cargo oil tanks. Liquid methane at —260° F. will be stored in these 10 tanks during the voyage. Fig. 1.



Here is a plan for natural-gas liquefaction at its source and tanker transportation of the liquid to a consuming center. For example, seven T-2 tankers could have supplied Philadelphia's natural-gas needs from Venezuelan fields in 1951. Approximate cost of the operation with tankers converted as outlined here: $0.0239 per therm.

Venezuelan Natural Gas for U. S.?

by John D. Crecca

LIQUEFACTION of natural gas is not new. It dates back to World War I. The possibilities of its commercial application have not been explored seriously, except for a period in the early 1940's, until the past few years. The extensive uses of natural gas as a fuel and raw material have revived the interest in natural-gas liquefaction.

The natural-gas fields of the Near East and Venezuela would be placed within reach of the large population areas of the world by a successful gas-liquefaction process, which will be described here.

Philadelphia area . . . In working out the details of such a system, Philadelphia has been chosen as the consuming area. There are two possible sources of natural gas. One is the Gulf Coast and the other Venezuela. It has been found that the transportation costs are less from Venezuela when using a foreign flag T-2 tanker burning part of its methane cargo as fuel.

For experimental analysis, a Maritime Commission T2-SE-A1 Tanker was chosen for conversion, utilizing the centerline row of tanks for the liquid methane, for four reasons: (1) the initial capital risk is less than a new ship; (2) natural gas and oil are compatible cargoes (both natural gas and crude oil will be carried); (3) the tanker is better suited for conversion than a dry-cargo ship; (4) the size of the vessel makes it suitable for both coastal and overseas operation.

The outstanding feature of the tanker conversion is the installation of stainless steel (18-8) rectangular tanks for the storage of methane at —260° F. in the centerline row of eight cargo oil tanks and in the two smaller forward cargo oil tanks (see Fig. 1).

The tanks are insulated by 10 in. of polystyrene covered with 2 in. of balsa wood. The insulation is placed inside the tanks in order to keep the liquid and metal from contacting.

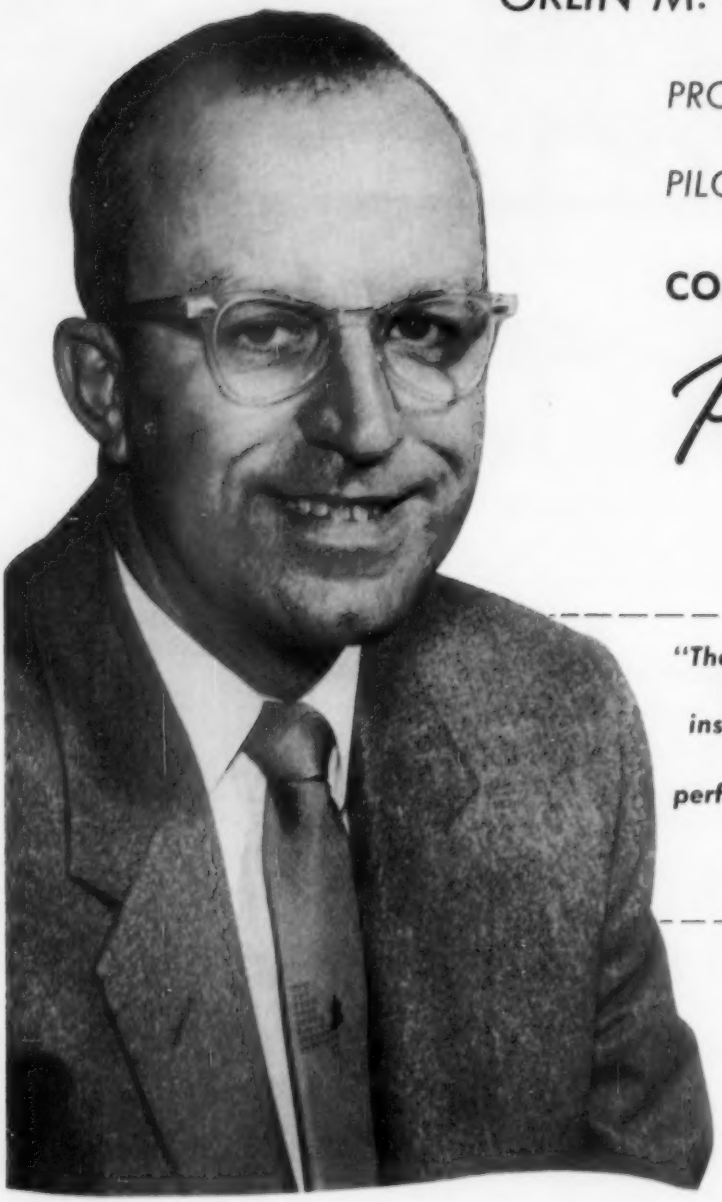
An inner bottom is placed over the existing floors (frames). This inner bottom serves two purposes: (1) formation of oil storage tanks between this inner bottom and shell (outer bottom); (2) protection of the ship's bottom and strength structure from embrittling action of liquid methane in

Author is with E. I. du Pont de Nemours & Co., Belle, W. Va. Studies on which this article is based were made under the auspices of Lehigh University.

ORLIN M. SORENSEN,

PROMINENT WEST COAST PILOT, SALUTES

COMMANDER 680-SUPER *Performance*



"The greater speed of the Commander 680 saves us hours instead of minutes — while the higher altitude, single-engine performance is a great safety factor."

Orlin M. Sorensen

Orlin Sorensen, chief pilot for Signal Oil and Gas Company of Los Angeles, has a record of business, transport and military flying that pre-dates World War II. His globe-wide experiences qualify him for flying and directing the Signal air fleet to business appointments throughout the country.

AERO *Commander*

For complete information see your nearest Aero Commander distributor or write for Catalog 120-S

AERO DESIGN & ENGINEERING CO • TULAKES AIRPORT • P.O. BOX 118 • BETHANY, OKLAHOMA

case of any leakage from the methane storage tanks.

Each compartment in which the liquid methane tanks are located is insulated on the inside. This will reduce to a minimum any cargo losses due to heating of the weather-exposed deck, heat from steam coils used to heat the cargo oil in the adjacent wing tanks, etc.

Piping system . . . A new piping system must be installed to load and unload the liquid methane. A separate stainless-steel suction and filling pipeline from each tank runs along the weather deck to a manifold connection in the midship deckhouse pumproom. The pipe has been run above the deck to eliminate the danger of a fire spreading from one tank compartment to another due to a pipe rupture.

All methane piping and manifolds are covered by outside insulation. A special connection at the intersections of the pipe with the deck and tank is provided to prevent any metal contact and insure thermal insulation.

An inert gas generator has been installed to provide inert gas for the void spaces between the methane storage tanks and the boundaries of the newly formed compartments. The inert gas will also be used for filling the empty methane tanks and purging the pipes. Since the methane may be vaporized by the pumps when the initial suction is placed upon the tank, the inert gas may be used to force the methane liquid to the pumps.

The present wing tanks will be retained to carry oil. Thus, the existing oil piping system, pumps, and pump room are retained to handle the oil cargo in the wings and the new double-bottom tanks formed by installation of the inner bottom mentioned above.

It is estimated that such a conversion will cost about $3,600,000 in an American shipyard. Such a ship will have a cargo capacity of about 88 M.M.c.f. of free gas and 70,700 bbl. of oil.

Liquefaction cycle . . . The proposed liquefaction cycle may be seen in Fig. 2. Since natural gas may have varying compositions, the design was based upon methane. Several cycles were examined including the cascade and several forms of the Linde. It was found that actual horsepower requirements of the proposed process (based upon efficiencies commonly used) were less than any of the theoretical requirements of the other cycles.

The advantages of the proposed process are: (1) elimination of any heterogeneous expansion; (2) gaining useful work while expanding the nitrogen; (3) taking advantage of the fact that a given increase in the compression ratio of a gas does not require nearly as much power to accomplish the compression as a proportional increase in the volume of flow.

The coolant is nitrogen. It is compressed in four stages to 1,500 psia. The high-pressure nitrogen is cooled by the returning low-pressure gas in heat exchanger A and then expanded to —270° F. and 80 psia. This gas is warmed to about —68° F. in exchanger B where the methane is liquefied. The low-pressure nitrogen then returns to the compressors after passing through exchanger A.

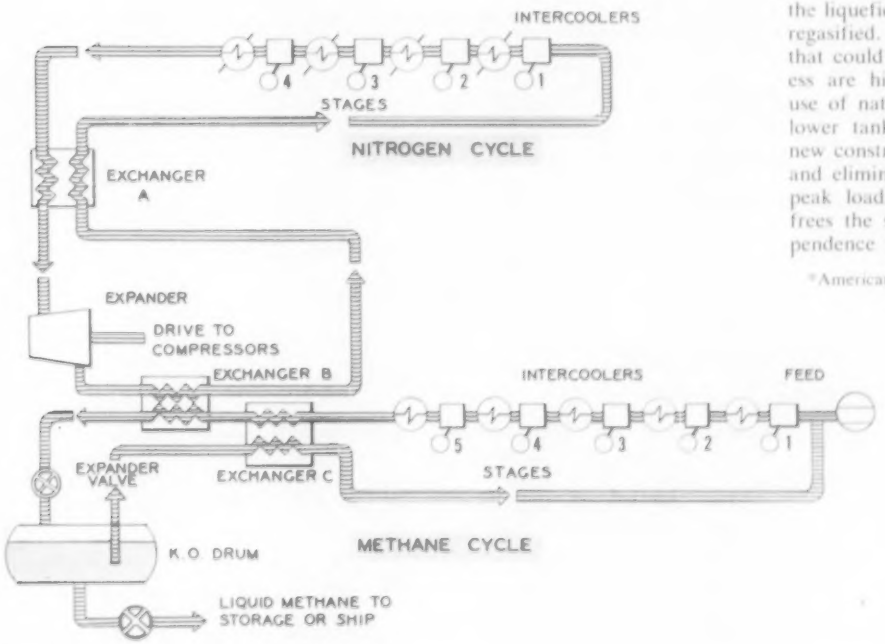
The feed methane enters the process at 50 psia. This extremely low pressure was assumed in order that the cost of the power equipment would be a high spot estimate. The feed gas is joined by the recycle and is compressed to 600 psia. in five stages. It is cooled in exchanger C and liquefied in exchanger B. The liquid methane is expanded to atmospheric pressure. About 45 per cent remains liquid. The vapor is returned to the compressors through exchanger C.

Shore facilities . . . The total cost of the shore facilities is about $30,000,000. This includes a plant to liquefy 44 M.M.c.f.d., piping, and 40 storage tanks. Thirty-eight will be needed at the place of consumption and the remainder will be used at the liquefaction port. This will provide enough storage for peak loads. Thus, the rate of delivery will be constant and there will be no need of manufactured gas.

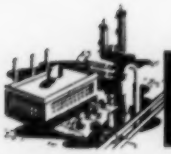
The volume of the system is based upon the 1951 consumption rate in Philadelphia as found in J. A. Carrol's article, "Economics of Peak Gas Loads."* Seven ships with a yearly capacity of 15,960 M.M.c.f. will be needed to carry the gas from Lake Maracaibo, Venezuela. The total cost of the operation is $55,000,000. The cost of liquefaction, transportation, and storage is $0.0239 per therm. This includes credit for the oil cargo carried simultaneously with the liquid methane.

It should be noted that no credit was assumed for the possible use of the liquefied gas as a coolant when it is regasified. Other cost-saving factors that could reduce the cost of the process are higher feed-gas pressures, the use of natural gas instead of methane, lower tanker cost per unit by use of new construction instead of conversion, and elimination of special facilities for peak loads. The use of storage tanks frees the system of any geological dependence for peak load storage.

*American Gas Association, 1951.



PROPOSED liquefaction cycle for the tanker. The design is based on methane, with nitrogen as coolant. Fig. 2.



JOB IMPROVEMENT FOR THE PROCESS FOREMAN—70

Obtaining Condensation of Overhead Product

FOR total condensation of overhead product the back-pressure regulator is installed in the overhead vapor line. Increased pressure opens the regulator which raises accumulator pressure and increases condensation and drops the pressure (see Fig. 13).

Total or partial condensation of overhead product is obtained by placing the flow regulator in the water line to overhead condensers. An auxiliary back-pressure regulator is put in overhead gas line. Increased pressure increases the flow of water to the condenser, thus lowering pressure. When the water valve is wide open, further pressure increase opens the control valve in the gas line to reduce pressure. Example is shown in Fig. 14.

Tower temperature control . . . Tower temperature controls are designed on the basis of one of the following requirements:

1. Required specification on overhead product. Example: Depropanizer controlled for per cent purity of the propane stream.

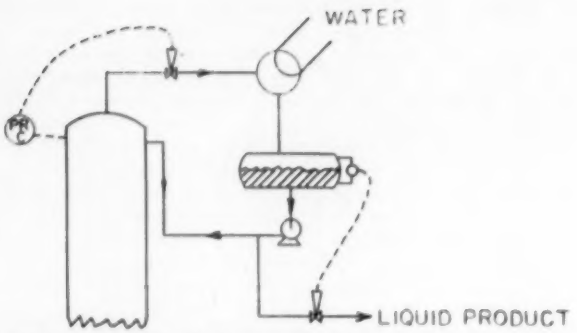
2. Required specification on bottoms product. Example: Depropanizer controlled for per cent propane in butane-butylene stream.

If the desired product is removed in the overhead, close attention must be given to control of the top temperature of the tower since this temperature controls the composition of the overhead product. In producing a bottoms product of given specification, temperature control of the bottom section of the tower is of primary importance.

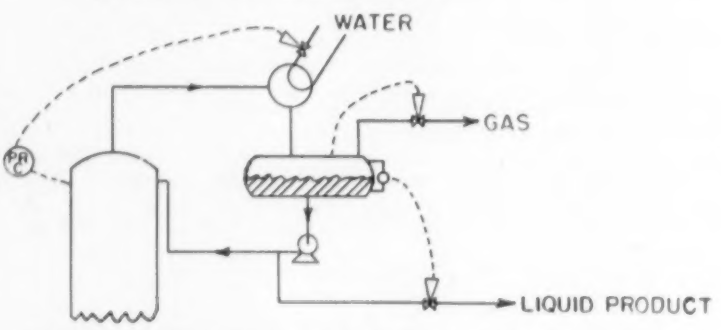
In a tower producing specification overhead product, the top temperature is controlled by varying the steam rate to the reboiler. Actually, the temperature used to actuate movement of the regulating valve may be a number of trays below the top of the tower.

This point is often used since it is more sensitive to temperature changes than the top tray and results in closer control. The tower bottoms temperature is not controlled in this scheme. Example is shown in Fig. 15.

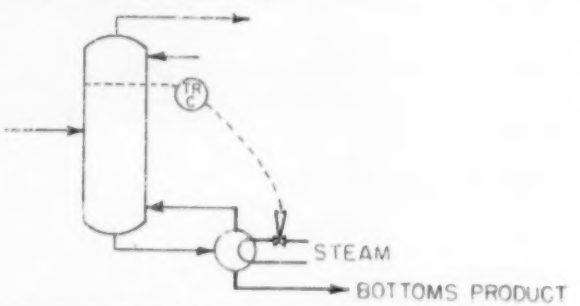
This material is taken from "Fundamentals of Refining," operating manual of Magnolia Petroleum Co., refining division, Beaumont, Tex.



TOTAL CONDENSATION of overhead product is presented when regulator is installed in vapor line. Fig. 13.



TOTAL OR PARTIAL CONDENSATION of overhead product may be obtained by placing flow regulator in water line. Fig. 14.



TOP TEMPERATURE may be controlled by varying steam rate to reboiler. Fig. 15.

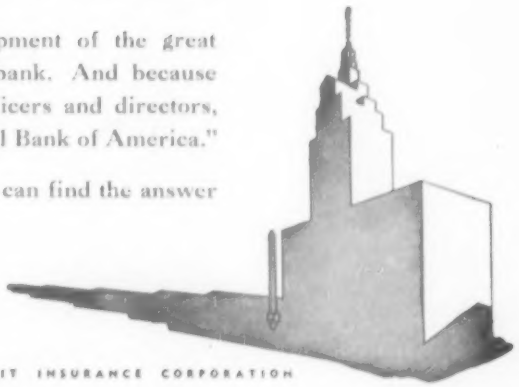
The OIL BANK of AMERICA

IN THE

Oil Capital of the World

Oil men who pioneered the development of the great Petroleum Industry, organized this bank. And because of the continued leadership of its officers and directors, this bank is still recognized as "The Oil Bank of America."

You, like thousands of our customers, can find the answer to your financial needs at NBT.



MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

NATIONAL BANK OF TULSA

The Oil Bank of America

OFFERING COMPLETE BANKING AND TRUST SERVICES

NATURAL-GAS DESULFURIZATION—2

Using the Recirculation Method of Revivification

by D. K. Taylor

THE recirculation method of revivification can be used successfully with a high-pressure purifier although there may be some question as to maximum space velocity which may be used under these latter conditions.

Empirical Rules-Purifier Design

1. Diameter . . . Purifier should be of such diameter that the rate of sulfur deposition shall be below 15 grains per square foot of cross-sectional area of the bed per minute.

This is necessary because the reaction of H_2S with Fe_2O_3 to form Fe_2S_3 and water is an exothermic one and if too much heat is evolved, the water of crystallization in the Fe_2O_3 molecule will be driven off and the activity of the material destroyed.

2. Temperature . . . We used to say that the temperature of the bed should always be below 105° F. for this reason, but we have found that for many years some users have been using higher temperatures. However if over 120° F. is encountered they must use a water spray in the top of their tower to keep the material wet to prevent loss of hydration. A water spray is not usually necessary if temperature is below 100° F.

3. Bed thickness . . . We have found that the oxide bed should be at least 10 ft. thick. This is necessary to produce a pressure drop across the bed, which is sufficient to create a high velocity of the gas between the particles.

The high velocity apparently has the beneficial effect of scrubbing off the stagnant gaseous or fluid film from the surface of the particle of iron oxide and thus allows the H_2S to come in to more intimate contact with the result that absorption reaction speed is multiplied approximately 10 times over the old low-pressure dry-box method.

4. Space velocity . . . Limited to maximum space velocities, sponge-bed volume should not exceed 240 cu. ft. per hour per cubic foot. This is calculated with the gas at flowing conditions and is simply another way of determining time of contact.

This figure of 240 also presupposes the use of the few tenths of 1 per cent oxygen necessary to have the reviving reaction take place simultaneously with the sulfiding reaction.

If it is not possible to add this small amount of oxygen, a lower space velocity should be used with low amounts of sulfur—below 50 grains per hundred cubic feet. It may not be necessary to reduce this upper space velocity very markedly. However, if there are over 50 grains, the top limit of 90 cu. ft. per hour per cubic foot should be used. These are not absolute quantities and with judgment they may be varied for the particular gas.

5. Mass velocity . . . In a paper by E. Ledoux *(Chemical Engineering, March 1948)* the upper limits for mass velocity with regard to churning of a bed were discussed. The work was done on a bed of moisture absorbing material used in the natural-gas industry for drying the gas.

Applying his general formulas and inserting the constants which applied for our sponge, we found that the pounds of gas per square foot per minute should be not over 39 times the square root of the gas density in pounds per cubic foot at flowing conditions.

Ledoux's work, however, was primarily on the basis of having upflow, through a purifier bed. This factor of 39 may be doubled; or 78 used for downflow. Downflow is recommended for other reasons as well. The principal one being that if any condensate is in the tower it will flow parallel with gas and there seems to be less tendency for channeling to take place.

6. Life of batch . . . There are two reasons for attempting to calculate the life of the batch: (1) to justify the process from the economic point of view; and (2) to determine the service life so the customer will know how often he must change the material.

In case one, where it is possible to add sufficient air to provide the few tenths of a per cent oxygen required for the reviving reaction; we recommend the use of our grade CH sponge which contains approximately 9 lb. of dry basis Fe_2O_3 per bushel. A bushel equals 1¼ cu. ft. but when it is packed into a 10-ft. thick bed (particularly since it must be packed tightly around the side walls) enough compression takes place to provide a bushel for each cubic foot of layer space.

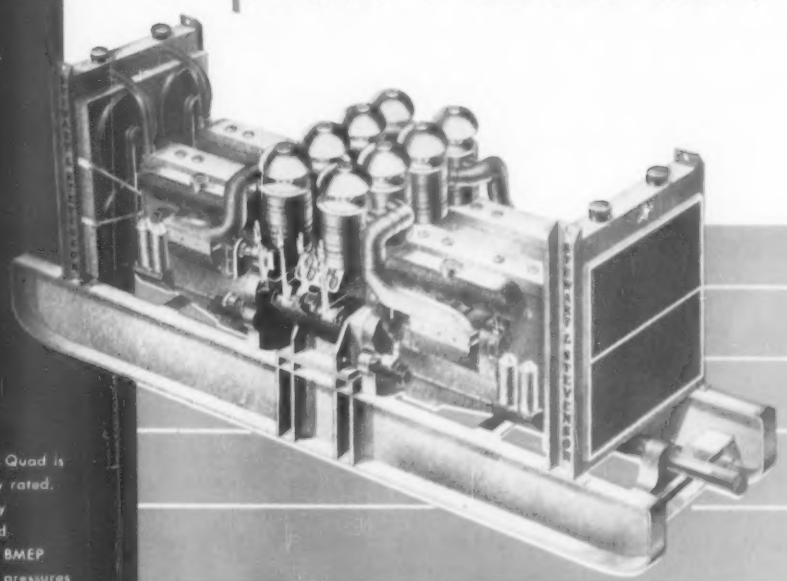
Author is western division manager, Connelly, Inc. Paper presented at Gas Conditioning conference, University of Oklahoma.

STEWART & STEVENSON...FIRST TO PRESENT A NEW MODEL 6-110 GENERAL MOTORS QUAD APPLICATION

It packs a 1000 H.P. WALLOP!

6-110 QUAD

55% MORE POWER



This new GM 6-110 Quad, adapted and developed by Stewart & Stevenson, brings to the oil industry a new concept of a compact, high horsepower package at reasonable cost. The new 6-110 Quad develops 880 to 1000 continuous horsepower, or up to 1200 intermittent H.P. It is the largest horsepower engine in its class. It develops more usable horsepower at speeds that are acceptable in more oil field applications than any other engine.

- Hydraulic actuated disconnect clutches. Power may be taken off either end of the 6-110 Quad. A dual power takeoff arrangement is also available.
- Reduced fuel consumption. The New 6-110 Quad delivers more horsepower per fuel dollar than previous units.
- The 6-110 Quad is conservatively rated. It is naturally aspirated and consequently BMEP and cylinder pressures are low.
- Standard General Motors Diesel Parts in both the gear and engine applications.
- Adapted, developed and guaranteed by Stewart & Stevenson, The Nation's Largest Distributor of Diesel Engines.

Several years ago, Stewart & Stevenson introduced the Series 6-71 Quad to the oil industry. No other engine unit has ever matched it for service. Now, here is a new, higher horsepower 6-110 Quad with the same characteristics for dependability and performance of the earlier model, *yet with 55% more horsepower.*

The new GM 6-110 Quad by Stewart & Stevenson utilizes approximately 98% standard GM Diesel Engine parts in both the gear and engine applications. It uses tandem twin gear parts in a newly designed and ruggedly built case of welded steel construction, designed especially for the 6-110 Quad application.

The New 6-110 Quad is very compact, and, in most instances, will fit into the same space as the earlier Quad 6-71. This new 6-110 Quad has the lowest unit cost of any diesel engine power arrangement with comparable horsepower.

Please write, phone or call your nearest Stewart & Stevenson Representative or Branch for complete details.

STEWART & STEVENSON

STEWART & STEVENSON SERVICES, Inc.

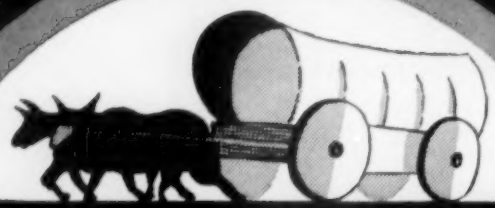
Main Office and Plant: 4516 Harrisburg Blvd., Houston 11, Texas. Phone CApitol 5-5241.

Branches: Corpus Christi, Dallas, Lubbock, San Juan, Odessa

Representatives: San Antonio, Longview, Brownsville, Tyler, Pecos

THE NATION'S LARGEST DISTRIBUTORS OF DIESEL ENGINES

PATENT CHEMICALS, INCORPORATED



MANUFACTURERS OF DYES AND CHEMICALS FOR THE PETROLEUM INDUSTRY

Your dependable source for...

Fluorescent colors and blooming agents used with additive compounded, solvent extracted lube oils
Dyes for gasolines, greases, waxes and industrial products
Petrol Ero Blue for Aviation gasoline

This material meets Mil-F-5572 Specification

Manufacturers of fluorescent indicator for F.I.A. absorption method hydrocarbon analysis. 'Petrol' Red AB4, a specially developed red dye for gasoline marking to meet Mil-F-5572 specifications. 'Petrol' colors for gasoline, kerosine, Diesel and tractor fuels. • 'Greasol' colors for greases. • 'Stero' colors for waxes.

Patent Chemical Company specializes in petroleum problems and preparation of particular products to meet special requirements involving dyes; fluorescent colors; additives; blooming, wetting, dispersion agents, etc.

SPECIAL PRODUCTS—

Fuel Oil Additives
Turbine Oil Additives
Petrol Blue Whiteners
Deblooming Agents
Gasoline Additives
Body Colors
Asphalt Bonding Agents
Dispersing Agents

PATENT CHEMICALS INC.

Manufacturing Division: 335 McLean Blvd., Paterson 4, New Jersey

PATENT FUELS & COLOR CORP.

Marketing Division: 2410 Carew Tower, Cincinnati 2, Ohio

Surroundings Affect Process Unit Surfaces

by J. O. Jackson* and Joseph Bigos†

PROCESS-UNIT environments vary in corrosivity toward steel from virtually no attack to extreme severity. Those process units in the mild classifications should be painted with the same paint systems as those used for tanks, but the finish coats selected should be based upon service requirements.

For the other extreme, the ultimate in protective coatings will be required. Organic coatings may not suffice, and stainless steel or plastic materials of construction may prove economical. Only the exterior of process equipment is considered herein for painting; but some units, such as water tanks, may be painted on the interior as well.

The class of environment surrounding the process unit will determine the protection required.

Simplified classification . . . Normal refinery atmosphere: Structural steel work, cracking units, fractionators, and towers with skin temperatures below 300° F.

High humidity: Units subjected to water spray, cooling water or humid air near the dew point, condensers, and cooling towers.

Condensation: Cold piping, refrigeration, cold water lines, and condensers.

Water immersion: Water-tank interiors, waste and sewage-treating units, and surfaces continuously wet.

Chemical:

1. Acid: Acid plants, acid-treating units, polymerization, alkylation, acids, isomerization units, and sludge handling.

2. Alkali: Alkali-treating and sweetening plants, neutralizing equipment, mercaptan removal, and doctor plants.

3. Solvents: Solvent treatment or process units.

Moderate temperature: Heat exchangers, stacks, towers, cracking units, and hot lines with skin temperatures between 300° and 550° F.

High temperature: Furnaces, stacks, mufflers, and hot lines with skin temperatures above 550° F.

Insulation: Variable in type of insulation and temperature.

Normal refinery atmosphere . . . Despite the complex chemical operations involved, most of the process units will fall into the first and simplest category — normal refinery atmosphere. Oil-base and alkyd paint systems will suffice. Paint System No. 1, "Oil-Base Paint Systems (For Weather Exposure)," and Paint System No. 2, "Alkyd Paint Systems (For Weather Exposure, High Humidity, and Infrequent Immersion)," are recommended.

If operating skin temperatures of refinery equipment is 300° F. or slightly higher, a medium oil-length alkyd system will usually work satisfactorily. The long-oil alkyds and oil paints should be kept below approximately 250° F.

The preceding two paint systems list numerous alternative finish coats, including glossy, semigloss, and flat finishes in a wide range of colors. Pumps, machinery, railings, stairs, etc., can receive special treatment by merely specifying the finish paints and color desired; e.g., a carbon-dioxide storage tank for fire protection may be painted bright red by specifying that the finish coat be Federal Specification TT-E-489b, color No. 1105.

Colors are easily specified by the use of Federal Specification TT-C-595. Free reign of color for safety, identification, and aesthetic reasons, as well as for other functional painting purposes, is possible by use of the paint systems.

High humidity: High humidity exists because of operational procedures, such as water sprays, or climatic conditions, such as exist in the Gulf Coast area. Extremely good surface preparation is the primary requisite for satisfactory paint life in this service and all increasingly difficult exposures.

Blast cleaning is most desirable and most economical; but because it is impractical around many process units, less satisfactory methods must often be used. Hand and power-tool cleaning, steam cleaning, flame cleaning, and solvent cleaning are used; but the life of the paint system is decreased.

S.S.P.C.-PS 2-55T, "Alkyd Paint Systems (For Weather Exposure, High Humidity, and Infrequent Immersion)," may be used for this exposure if actual immersion in liquid water occurs only infrequently. If the steel will be subject to virtually continuous condensation or liquid-water contact, then a paint system listed for condensation should be used.

Condensation: Before painting steel which is subjected to condensation an analysis first should be made of the source of trouble. If condensation occurs because of cold contents, then some form of antisweat coating is required; but if condensation occurs because of the extreme humidity of the environment, then a phenolic or vinyl paint system used for water immersion is best.

Cold surfaces . . . Antisweat coatings are used on cold surfaces which are frequently or constantly below the dew point. Their primary purpose is to act as insulation, thereby keeping the exterior surface of the coating above the dew point. For them to be effective, the ambient-air temperature must be considerably above the dew point. These coatings are likely to be wet or damp.

Phenolic paints are recommended to resist condensation. As a result, surface preparation must be thorough to prevent rusting and loss of adhesion; but hand cleaning is adequate if carefully done. Wash-primer pretreatment of clean surfaces is beneficial.

The objective is to build up a very thick film of good insulating properties. This is accomplished by using paint as a binder for lightweight porous material. Materials such as vermiculite or ground cork are used.

*Pittsburgh-Des Moines Steel Co., Pittsburgh. †Senior Fellow, Mellon Institute of Industrial Research. Paper presented at A.P.I. Refinery Division meeting, Montreal, 1956.

choose from 3 approaches to higher octanes with ISO-PLUS HOUDRIFORMING

The new HOUDRY ISO-PLUS Process combines the proved advantages of catalytic HOUDRIFORMING with other processes to economically reform low-octane naphthas into gasolines with octane ratings in excess of 100-octane F-1 clear. This catalytic reforming process offers refiners practical approaches to higher octanes at relatively low investment.

High-Octane Alternatives with ISO-PLUS HOUDRIFORMING

ISO-PLUS Aromatics Extraction Combinations

1. Iso-Plus Houdriforming with separate Houdriforming of paraffinic raffinate

2. Iso-Plus Houdriforming with recycling of paraffinic raffinate

Variations of the Iso-Plus Process employing aromatics extraction have produced yields of 100-octane gasoline, F-1 clear, of up to 91% of naphtha charge. Slight changes in operation permit refiners to further increase gasoline product octane.

ISO-PLUS Thermal Processing

3. Iso-Plus Houdriforming with thermal reforming of Houdriformate

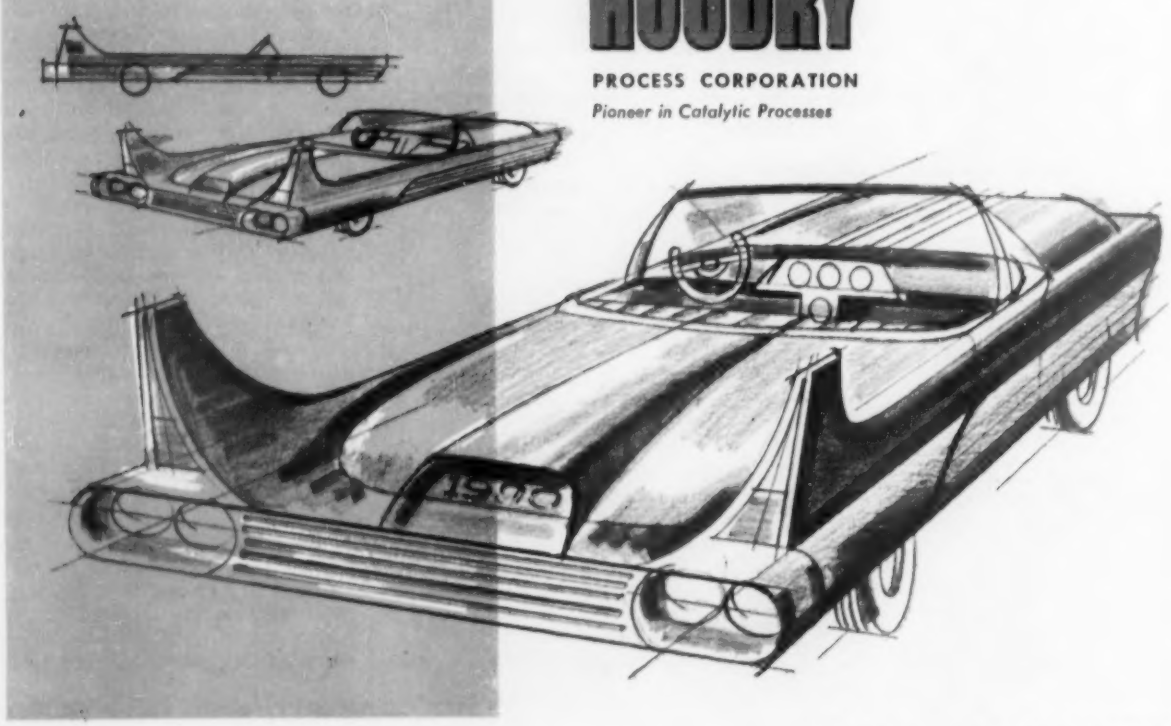
With thermal reforming as the supplementary process, Iso-Plus processing yields 80% to 90% of reformed gasoline, depending upon the desired octane rating of the final product. This operating scheme is especially attractive to refiners with available thermal reforming equipment.

For further information, write to Houdry Process Corporation, 1528 Walnut Street, Philadelphia 2, Pa.

HOUDRY

PROCESS CORPORATION

Pioneer in Catalytic Processes



by W. L. Nelson
Technical Editor

21. Cost of Insulation

Cost Indexes (1946 = 100) for insulation materials

	Buildings	High temp.*	Nelson Index†
1946	100.0	100.0	100.0
1947	118	122	117.0
1948	127	140	132.5
1949	124	146	139.7
1950	125	152	146.2
1951	129	167	157.2
1952	130	168	163.6
1953	134	176	173.5
1954	136	179	179.5
1955	132	180	184.2

*Estimated.

TABLE 3—COST OF MAGNESIUM BLOCK INSULATION—1946
(Dollars per sq. ft.)*

Thickness, in.	Material[2,5]	†Labor[2,5]	†M & L
½-1	0.14-0.24	0.94-1.28	1.10-1.40
1½-2¼	0.24-0.50	1.00-1.50	1.20-2.85
2½-3	0.42-0.58	1.10-1.60	1.50-2.00
3½-5	0.60-0.75	1.20-1.70	1.80-2.30

*The larger material costs are for thinner insulation. †The large values are for heights above 25 ft. and the low values for heights below 12 ft. Includes hauling, scaffolding, waste, wire, ½-in. cement and labor at $2.75 per hour but no asphalt covering.

TABLE 1—RECOMMENDED THICKNESSES OF OUTSIDE* INSULATION[2-5] (INCHES)

Temp., °F.	2-in. Pipe and smaller	2-4-in. Pipe	Vessels, towers and large pipe
Low	⅞	1 or std.	1 or std.
200-268	⅞	1 or std.	1½ or std.
268-338	⅞	1 or std.	1½
338-388	⅞	1½	1½-2
388-500	1½	2	2
500-600	1½	2	2½
600-700	†2	‡2	‡2½
700-800	†2	‡2	‡3
800-900	†2	‡2	‡3
900-1,000	†2	‡2	‡3½
1,000-1,200	2½	‡2	‡3½-4

*Inside location ½ in. less thick, for underground 1 in. less thick, and for fire protection ½ in. less thick; but these apply only to insulation 1½ in. or thicker. †Reference 5 uses only diatomaceous silica (high-temperature insulation). ‡Reference 5 uses thinner magnesia or wool by ½-1 in. but employs about the same amount of diatomaceous silica as well as the magnesia.

References

1. Nelson, W. L., The Nelson Refinery Construction Cost Index, The Oil and Gas Journal, July 7, 1952, p. 105. (The Index also appears in the first issue each month, and in addition, indexes for many items of equipment are published in the first issues of January, April, July, and October.)
2. Otto, F. C., Estimating Magnesium Insulation Costs, Chem. Eng., Sept. 1947, p. 126.
3. Nelson, W. L., Pipe Insulation, The Oil and Gas Journal, Jan. 27, 1949, p. 351; also Tower Insulation and Platforms, Jan. 13, 1949, p. 101.
4. Author's files.
5. Hanson, L. A., Insulation Data on a Large Combination Unit, Pet. Refiner, Sept. 1947, p. 112.
6. Otto, F. C., Estimating Mineral Wool Insulation, Chem. Eng., July 1947, p. 102.

TABLE 2—COST OF INSTALLED PIPE COVERING,[2,4,6] DOLLARS PER LINEAR FOOT, 1946*

Pipe size (in.)	Standard M	Standard I.	Standard M & I.	1½ in. thick, M & I.	2 in. thick, M & I.	3 in. thick M	3 in. thick I.	3 in. thick M & I.
¾	.14	.77	.91	1.14	1.37	.77	1.01	1.78
1	.16	.78	.93	1.18	1.42	.80	1.03	1.83
1½	.19	.83	1.02	1.27	1.52	.89	1.08	1.97
2	.21	.86	1.07	1.33	1.59	.95	1.11	2.06
3	.26	.91	1.17	1.45	1.72	1.09	1.16	2.25
4	.34	.96	1.30	1.56	1.88	1.26	1.21	2.47
6	.46	1.06	1.52	1.79	2.19	1.55	1.31	2.86
8	.63	1.26	1.89	2.13	2.56	1.81	1.51	3.32
10	.75	1.50	2.25	2.54	3.03	2.10	1.75	3.85
12	1.06	2.12	3.18	3.18	3.82	2.36	2.37	4.73
16	1.35	2.44	3.79	3.79	4.49	2.92	2.69	5.61
20	1.64	2.96	4.60	4.60	5.41	3.44	3.21	6.65
24	1.90	3.04	4.94	4.94	5.77	4.02	3.49	7.31
30	2.30	3.70	6.00	6.00	7.01	4.82	3.95	8.77

*Based primarily on magnesia insulation. Mineral wool is somewhat cheaper in larger sizes but with labor costs, the installed cost is much the same. High-temperature diatomaceous earth or silica insulation costs 40 to 90 per cent more. Includes material, cement, hauling, scaffolding, and weatherproof cover.

RESISTS HIGH TEMPERATURE CORROSION!

Alumicoat

Molten Aluminum

PROCESS PROTECTS REFINERY EQUIPMENT

More and more refineries are discovering the advantages of the new ALUMICOAT Process! ALUMICOAT offers a firm resistance against corrosive media — *especially sulphur compounds* — and extreme temperatures!

In the ALUMICOAT Process, refinery parts are dipped in molten aluminum to produce a metallurgical iron-aluminum bond at the interface and a surface overlay of pure aluminum. At temperatures exceeding the melting point of aluminum, the aluminum on the surface diffuses. This diffused coating, together with the iron-aluminum bond, provides a refractory material that gives steel maximum protection against high temperature scaling.

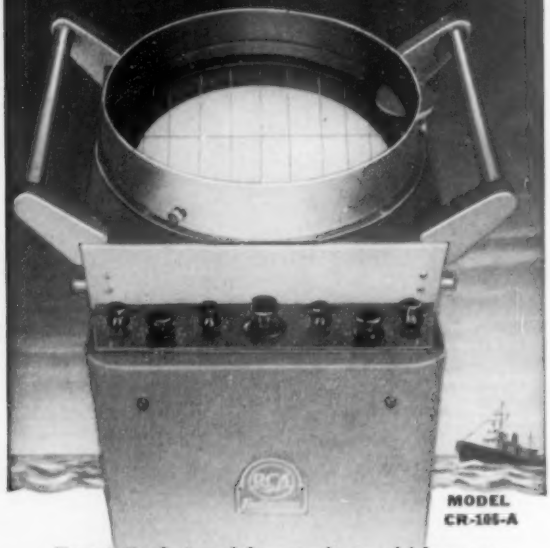
The Alumicoat Process can solve your corrosion and oxidation problems. Send for full details today!

ARTHUR TICKLE ENGINEERING WORKS, INC.

24 A Delevan Street MAin 5-4200 Brooklyn, N. Y.

New Radiomarine Small Boat Radar

- Saves Money
- Saves Space
- Saves Power



MODEL CR-105-A

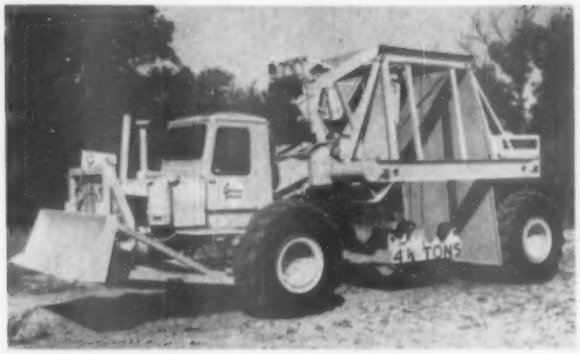
Especially designed for vessels on which space and power are limited, Radiomarine's new CR-105-A Radar offers you the EXTRA features that give you MAXIMUM PERFORMANCE—MAXIMUM CONVENIENCE—MINIMUM MAINTENANCE. Only two basic units—indicator and antenna. Indicator is in deck mounted binnacle . . . keeps picture tube high for best viewing . . . requires less than two square feet of deck space. Antenna is lightweight . . . only 105 pounds. Instant selection of 1-2-4-12-32 mile ranges helps you navigate through foul weather and traffic hazards to cut your trip-time, boost your profits. You'll read the clear, bright pictures on its 10-inch scope easier . . . service it quicker with the easy-access chassis. And here's another saving . . . the Radiomarine CR-105-A requires only 600 watts from ship's battery or other D.C. power supply. Find out more about the new Radiomarine CR-105-A . . . it can mean greater profits for you right now.

RCA write for free information now!

RADIOMARINE SALES

RADIO CORPORATION of AMERICA

75 VARICK STREET, NEW YORK 13, N.Y.



More seismic energy per drop . . .

Plus new tricks in energy recording, give . . .

New Seismic Technique . . .

. . . promises better results in difficult areas

WEST TEXAS geophysicists have developed an improved weight-dropping technique that has several advantages over previous methods. The new method . . .

- Generates more seismic energy.
- Improves signal-to-noise ratio, giving usable seismic records in several areas that previously were N. R. areas.
- Gives improved seismic quality at lower cost in less difficult areas.

Geophysical Integrators, Inc., San Angelo, have taken the weight-dropping technique of seismic mapping and come up with several improvements that give better seismogram quality and a lower cost per acre for geophysical work in hard-to-shoot areas. The old technique consisted of dropping a heavy weight that was suspended from the rear end of a truck. This generated seismic energy that was recorded conventionally.

Geophysical Integrators have changed from a truck to a "Tournapull" earth-moving tractor. This enables them to use a much larger weight and gives considerably more seismic energy per drop. In addition, the tractor eliminates undesirable vibrations that are set up by the truck-mounted weight.

The Tournapull can operate in rugged terrain because it has a bulldozer blade for improving trails if necessary.

RECORD-ANALYZING UNIT is trailer-mounted for field-office processing of seismic data.

Rapid data handling . . . Recording of seismic energy is handled in an observer's truck that is equipped with instruments of a "new and flexible design," according to Geophysical Integrators.

The record-analyzing unit is trailer mounted for field-office processing of the seismic data. This permits analysis and photographing of records as soon as they are recorded in the field.

The new integrator is designed for and will perform any and all of the functions of any modern geophysical integrators, H. I. Henderson, executive vice president of Geophysical Integrators, said. It is capable of making all corrections desired by the geophysicists accurately and swiftly. This information is placed on a permanent film.

G.I.'s new integrator is designed for field use rather than for central-office integration that is so common in the industry today. Each field crew is equipped with the integrator and it is set up in a modern house-trailer. This serves as an office for the geophysicist. All corrections, integrations, and interpretations are made in the field office. The preliminary interpretation is available to the client in less than 24 hours.

From Calgary to Kuwait, wherever oil men seek unlimited flexibility in handling fluids, semi-solids and gases, you will find Chiksan Swivel Joints in service. And wherever temporary piping calls for quick, make-and-break wing nut unions, chances are they're Weco Unions.

The reason for this is *proven performance*. Performance that has measured up under the most rugged conditions. Also, Chiksan and Weco's world-wide distribution assures prompt delivery when and where you want it.

Small wonder then that wherever men seek, drill, produce, transfer or process oil, you find dependable Chiksan and Weco products in service.

SERVING

the oil men of the world

CHIKSAN

WECO

CHIKSAN SWIVEL JOINTS

WECO UNIONS

SOLD AT LEADING SUPPLY STORES EVERYWHERE

A SUBSIDIARY OF FOOD MACHINERY AND CHEMICAL CORPORATION

fmc

CHIKSAN

CHIKSAN COMPANY—BREA, CALIFORNIA • CHICAGO 5, ILLINOIS • NEWARK 2, NEW JERSEY

Well Equipment Mfg. Corp. (Division), Houston 1, Texas • Subsidiaries: Chiksan Export Company • Chiksan of Canada Ltd.

Among the

Drilling Contractors

Louisiana Group Forms Offshore Drilling Company

Universal Drilling Co., Inc., headquartering at New Orleans, is a newly formed contract-drilling company to engage in offshore operations in the Gulf of Mexico.

Heading the company as president is Louis J. Roussel, independent oil operator for more than 20 years. Associated with him is a group of oil and gas operators, industrialists, water transportation operators, and financiers, including:

Earl S. Binnings, Francis E. LeJeune, John F. Hartmann, Baltzer A. Brignac, Sidney L. Russell, O. B. Trotter, George C. Foltz, R. J. Carlos Tricou, Wallace P. Fuselier, J. G. Cocchiara, Forrest C. Pendleton, and Allen H. Generes.

The company is completing plans for construction of an offshore drilling barge capable of operating in water up to 120 ft. deep.

Cron & Gracey Corp., Houston, has a new deep wildcat operation 1½ miles off the southeast flank of the old Lockport dome, southwest of Lake Charles, in Calcasieu Parish, southwestern Louisiana. It is a contract job for Austral Oil Exploration Co., Inc. Location is on a state waterbed lease in Lake Prien. A 12,500-ft. depth is planned.

Delta Gulf Drilling Co., Tyler, Tex., will drill another deep test for M. L. Mayfield at Amelia, in Assumption Parish, Louisiana Gulf Coast. It will be Mayfield's 4-A Lutcher-Moore, in 63-16s-14e. Permit calls for a 14,500-ft. well.

Sunnyland Contracting Co. Rayne, La., has a new operation under way for Humble Oil & Refining Co. in North Lake Lucille field, Adams County, Southwestern Mississippi. It is Humble's second test in the immediate area, and will attempt to confirm the company's oil-discovery at 1-H Breaux, completed in a 6,730-ft. Wilcox sand. The confirmation test, 2-G Breaux, in 1-4n-4w, is projected to 7,300 ft.

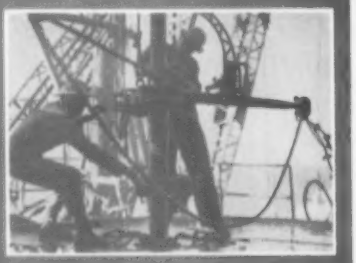
Stone Drilling Co. is contractor on a deep test Pure Oil Co. is starting about 3 miles east of Echol field, in eastern Lea County, southeastern New Mexico. The operation, 1-D State-Lea, in 10-11-38, is set up for a 12,100-ft. test.

Wilson Drilling Co., Jackson, Miss., is in a drilling deal with Clyde E. Moss, also of Jackson, for a Wilcox test 4½ miles southeast of Avoyelles Parish, in East Central Louisiana. The test, 1 Snowden, in 23-2n-5e, is projected to a depth of 8,000 ft.

Woolf & Magee, Tyler, Tex., will drill a 7,900-ft. Lower Cretaceous test about 3¾ miles east of Sherwood, in Catahoula Parish, East Central Louisiana. It is a contract job for A. J. Hodges Industries, Inc., and associates.

AIRPORT DRILLING at Pauls Valley, in Garvin County, Oklahoma, where Goldsmith Drilling Co. has a rig working for Hefner Production Co. on an indicated oil-discovery well, 1 City of Pauls Valley Airport. Shown at the rig are, left to right: Durbin Branch, Hefner geologist; Clyde Brown, Marvin Stagner, Jim Barks, and Pete Cole (driller), rig crew; and Stanley Haiper, tool pusher.

CUT *shop expense*



Cut shop expense on your drill collars by using 'Bestolife Lead Seal. Because of its high percentage of powdered metallic lead, 'Bestolife is heavy enough to stay on threads and shoulders instead of being squeezed out. This gives you extra tight leak-free joints, which are easy to break out. That's why 'Bestolife is first choice with tool pushers all over the world. See your local supply store for 'Bestolife. In 1¼, 5, 20 and 50 lb. cans. Unconditionally guaranteed.

I. H. GRANCELL
1801 EAST WADEAU STREET
LOS ANGELES 1 CALIFORNIA

NOW BUYS
MUDWONDER

W. W. "Bill" Sauer of Gabe McCall Drilling Co. now buys Mudwonder Mudline Valves to stop downtime.

Edward Valves, Inc., Subsidiary of Rockwell Manufacturing Company, East Chicago, Ind.

MURPHY PROTECTS DAY AND NIGHT

MURPHY Safety Switches Protect All Unattended Oilfield Engines

MURPHY Automatic Switches Are All You Need

NEW MODEL W-275 for Single Magneto Engines

Featuring new automatic lube oil disconnect switch. Pushbutton sets lockout. Normal oil pressure automatically resets switch when engine is started.

Model W-275-D, slightly larger panel, provides space for #101-D instant snap switch for dual magneto engines.

All Murphy controls are heavy duty, field-tested, made of finest materials, guaranteed one full year. Low-cost replacement parts quickly available.

See Your Oilfield Engine Dealer or Write for Information

FRANK W. MURPHY Manufacturer
BOX 1476 TULSA, OKLA.
BRANCH LOS ANGELES 61 CALIFORNIA

SAFE

INFERNO Gage Cocks

These gage cocks are designed so that the generous diameter of the seating disc and the hinged arrangement of the handle combine to deflect steam away from the operator. Eliminates the danger of steam hitting the operator. For further information write for new Bulletin No. 38.

THE INFERNO CO.
Box 11384
115 RICOU St.
SHREVEPORT, LA.

Location is at 1 Louisiana Central, in 17-10n-6e.

Vasser & Brown, Inc., Natchez, Miss., has a new contract operation in the Indian Lake area, of eastern Franklin Parish, northeastern Louisiana. It is 5,500-ft. Tuscaloosa test for J. A. Harper, of Crowville, La. Location at 1 Golsby, in 15-15n-9e, is 2 miles south of Lamar field.

Gossett & King, of Luling, Tex., have taken a contract for a 3,000-ft. wildcat test in Bexar County, Southwest Texas. Operator is John Coffee, of Houston, whose location at 1 Timberland, in the Juan Manuel Urriegas Survey, is at the southwest edge of San Antonio.

Vick Drilling Co. is contractor on a 4,600-ft. test F. R. Jackson, of Longview, Tex., is starting 8 miles east of Rusk, in Cherokee County, East Texas. The operation is listed as 2 Walker, with location in the J. M. Musquez Survey.

Milton Crow, Inc., Shreveport, is on a 7,500-ft. contract job 1½ miles northwest of Tensas Bluff, in Tensas Parish, eastern Louisiana. Francis W. Scott, also of Shreveport, is operator. Location is at 1 Ayer, in 23-14n-10e. It is a Paluxy test.

Parker Drilling Co., Tulsa, has contracted with Phillips Petroleum Co. for a deep wildcat test to be drilled about 10 miles north of Lovington, in Lea County, New Mexico. Location, at 1 Austin, in 17-14-36, is about 5 miles north of Caudill field, nearest production. Contract calls for a 14,500-ft. test.

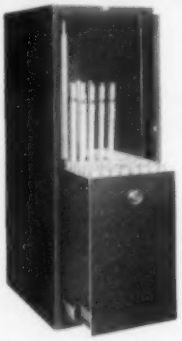
J & C Drilling Co., Refugio, Tex., is drilling for Morgan Exploration Co. on a newly started deep wildcat in Kleberg County, in the lower coastal sector of Texas. Location is 6 miles southeast of Richardo. Plans call for a 10,000-ft. test at 1 Huff.

Payne Drilling Co., Corpus Christi, has a new wildcat operation 4 miles northwest of Sinton, in San Patricio County, South Texas. It is a contract job for Delhi-Taylor Oil Corp. at 1 Hayes, in the George Morris Survey. Hole is projected to 8,100 ft.

Oil Corp., Corpus Christi, is contractor on a 6,000-ft. test Chicago Corp. and Republic Natural Gas Co. are starting at a wildcat location 12½ miles southwest of Corpus Christi. Location is at 4-37 Chapman Ranch, in Section 27, Laureles Farm Tracts, in Nueces County, Texas.

KRAFTBILT

OIL INDUSTRY FILING EQUIPMENT



VERTICAL ROLLFILE V-96

Vertically files subjects to 56" in 1⅞" tubes. Indexing on ledges gives immediate file control. Locking door disappears, drawer rides on roller bearings. Perfect balance, will not tip over.

Horizontal Rollfile H-342

Electric Log Cabinet E-24

Filing Supplies to fit perfectly available for all KRAFTBILT units.

WRITE for Catalog 1156-B on Kraftbilt

ROSS-MARTIN COMPANY
P. O. BOX 800 TULSA 1, OKLA.

Completely Air-Conditioned
Centrally Located
Adjacent Garage

BUSINESS and PLEASURE in TULSA means . . .

THE MAYO
TULSA's world-famous HOTEL

LD 381

Over
60
Locations in the United States and Canada

McCullough® REPORTS TO THE OIL INDUSTRY

Service
Anywhere Anytime

New Services • • • New Tools • • • New Methods • • • Outstanding Results

Locates Pay Sand Missed by Electric Log

In a shallow well in Oklahoma the McCullough Radiation Well Log picked up 23' of pay that had been missed by an electric log.

The electric log had picked a hard limestone as the pay zone. 5½" O.D., 14 lb. casing was set to bottom. Limestone formation was perforated and found dry. Then McCullough was called to run a Gamma Ray Log. At approximately 1100', and just below the hard limestone, the McCullough Log picked up 23' of shaley pay sand. This entire productive zone had been missed by the electric log.

The accurate and reliable information supplied by the McCullough Radiation Well Log (Gamma Ray and Neutron Curves) provides a sound basis for perforating for completion . . always Log AND Perforate by McCullough.

Efficiency of McCullough Services Saves Operator Valuable Rig Time

Only 7⅛ hours were required to log, perforate and set a packer in this Texas well.

5½" O.D., 17 lb. casing was cemented at 7716'. Well was logged by McCullough from 7716' to 5000', obtaining gamma ray and neutron curves and recording a simultaneous collar log. Twenty McCullough Standard Casing Glass Jets, four per foot, were shot in the interval from 7482' to 7487'. This was followed by setting a production packer at 6410'.

In this series of operations there was no delay of any kind – a tribute to the efficiency of McCullough tools and instruments and to the skill of McCullough service crews.

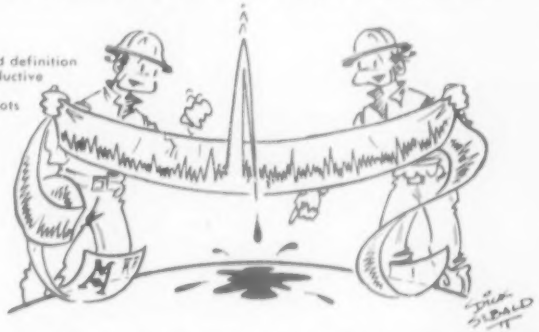
$2,433.21 SAVED

Accuracy of McCullough Radiation Well Log Prevents Wasting 390 Perforating Shots in Non-productive Shale Zones... Helps Increase Production 178 B/D

The decision to run a McCullough Radiation Well Log was worth $2,433.21 to this California operator. 390 shots would have been wasted in dry shales except for the discovery of a ten-foot error in electric log measurements.

Well had been bottomed at 11,237' and the electric log was run in open hole. A 5½" O.D., 23 lb. slotted liner was set through the productive interval. Well was put on production and slowly settled down to 22 barrels per day.

Operator decided to perforate liner to attempt to increase production. It was known that there were eight zones separated by shale beds to be perforated. A McCullough Radiation Well Log was run to exactly locate these zones and to check previous measurements. When correlated with the old electric log it was found that there had been a ten-foot error in depth measurement.



Exact measurement and definition of any potentially productive interval, thick or thin, assures "putting the shots where they count" for greater production — more oil!

The eight zones were perforated with a total of 1332 shots, four holes per foot, from the detailed data provided by the McCullough Log. 660 of these were ½" improved Ogival Bullets fired by 3½" O.D., McCullough M-3 guns, 2 holes per foot. The remaining 672 shots were fired by McCullough Standard Casing Glass Jets with Steel Strip Carriers, 2 holes per foot.

Production increased from 22 to 200 barrels of oil per day.

This job particularly emphasizes the extreme value of the accuracy and efficiency of the McCullough Radiation Well Log to the operator. Engineers of this company estimated that, had the well been shot by the old electric log measurements, 390 of the 1332 shots would have been placed in the non-productive shale beds separating the pay zones. At prevailing prices this would have meant a loss of $2,433.21 because of wasted shots. In addition the resulting production would have been considerably lower because of improper coverage of the eight zones.

It always pays to run a McCullough Radiation Well Log before perforating.

McCullough® TOOL COMPANY

Cable Address: MACTOOL

LOS ANGELES
HOUSTON
EDMONTON

PIPELINES

ACROSS THE CONTINENT...

. . . R. H. FULTON & CO.

CONTRACTORS • LUBBOCK, TEXAS

Centrifugal Compressors—3

Pipeline loads determine compressor requirements

MOST of the compressor — casing, shaft, bearings, seals, supporting structure, oil system, accessories, and controls—remains unchanged from the initial installation.

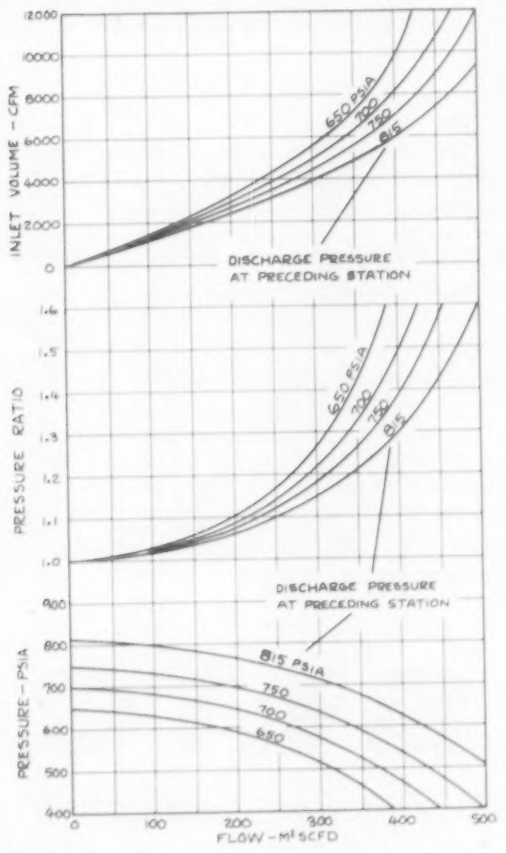
Unit size . . . It is possible usually, by proper selection of the compressor size and speed, to accommodate a growth in the pipeline load of the order of 2 to 1 by changing impeller and diffuser. When the flow is low, a small-capacity large-diameter impeller which delivers a high-pressure ratio is used.

As the flow increases, large-capacity smaller-diameter impellers for lower

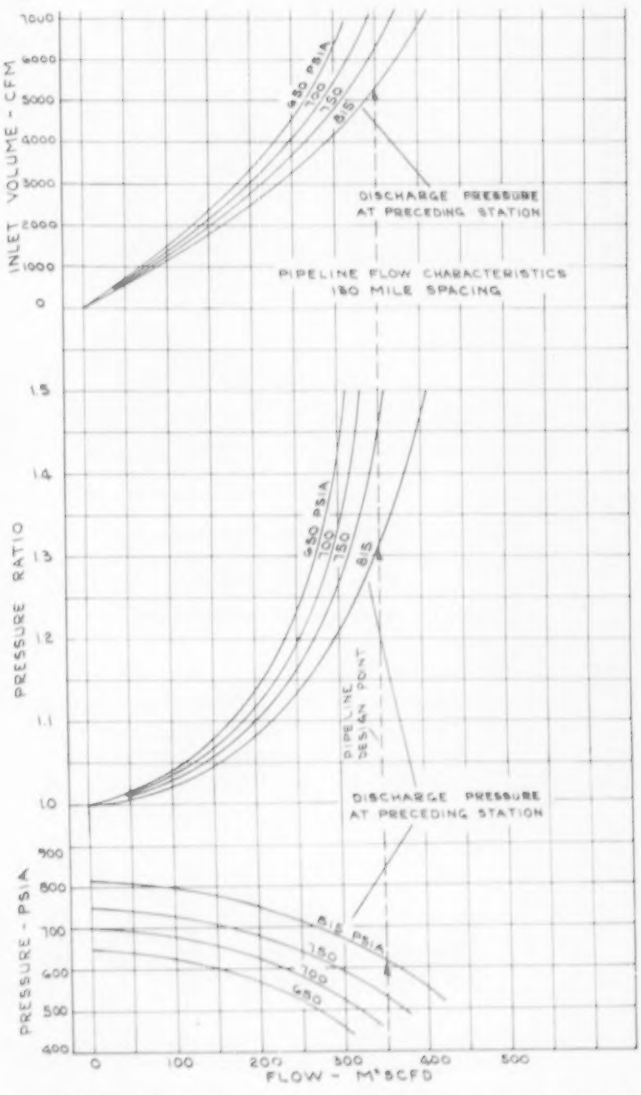
Material furnished by C. F. Koenig III, and L. J. Holveck, De Laval Steam Turbine Co., Trenton, N. J.

TABLE 3—COMPRESSOR REQUIREMENTS

	Initial	Intermediate	Ultimate
Flow, M.M.s.c.f.d.	350	550	800
Station spacing, miles	130	65	32.5
Number units per station	1	2	3
Over-all station pressure ratio	1.315	1.390	1.395
Total station horsepower	4,900	9,650	14,150
Station inlet volume, cu. ft. per minute	5,300	8,830	12,900



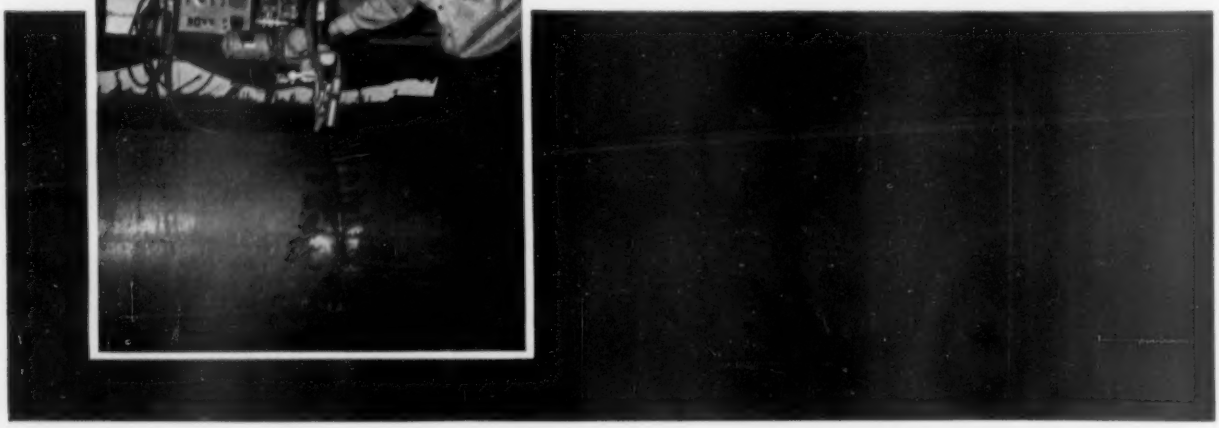
PIPELINE-FLOW characteristics for 97½-mile station spacing. Fig. 9.



PIPELINE-FLOW characteristics for 130-mile station spacing. Fig. 10.

New 60-foot joints of Republic require only 88 welds per mile

(Below) Stringer bead for joining two 30-foot joints of Republic Electric Fusion Weld Pipe is applied at "line-up" station. Perfect alignment is possible, with precise separation of lands on rust-free bevel. Note rubber-tired rolls used to cradle pipe. (Left) Here the first of two fully automatic passes is made by submerged arc welding, employing latest equipment and methods.



Under normal conditions, crews welding big-diameter line pipe can usually complete about 150 girth welds per day regardless of the individual length of each joint. In terms of total length, this amounts to 4500 feet of line using 30-foot joints . . . or 6000 feet where 40-foot joints are used.

With Republic's new 60-foot joints of Electric Fusion Weld Line Pipe, welding crews can progress at the rate of 9000 feet per day. The result: *a saving of approximately 147 working days in a 500-mile line!*

This new, economical length, a Republic exclusive, is produced by joining two 30-foot joints under ideal welding conditions. Each welding operation is carefully controlled, resulting in a midweld of equal quality to the longitudinal weld. This consistent uniformity is typical throughout every joint of Republic Electric Fusion Weld Line Pipe.

Because circumference is always constant, field joints line up accurately, permitting high-speed girth welding. Uniform wall thickness assures an even distribution of metal all around the pipe—with no thin spots to worry about. Precision manufacturing techniques produce high ductility and yield strength, keys to maximum dependability in high-pressure service.

Republic, a leading pipe producer for more than 25 years, makes steel pipe for every oil and gas handling need. Electric Fusion Weld comes in sizes from 24″ through 30″ O.D.; Electric Resistance Weld from 2⅜″ through 16″ O.D.; and Continuous Butt Weld from ¼″ through 4″ nominal.

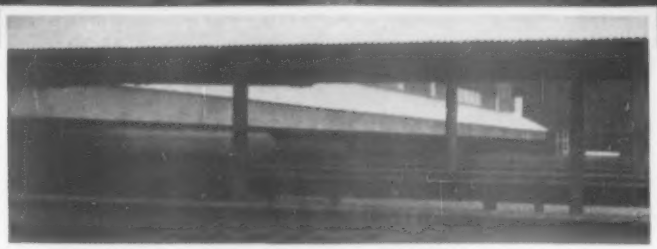
Get all the facts from your local Republic office. Or mail coupon for literature.

REPUBLIC

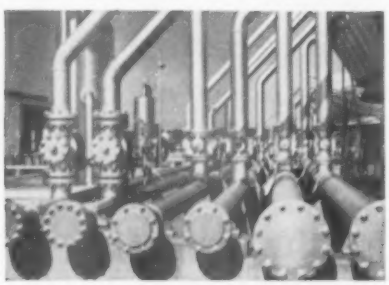
REPUBLIC STEEL

World's Widest Range of Standard Steels

Electric Fusion Weld Line Pipe ...cut completion time by 33%



(Right) Pipe is shown on conveyor coming directly from the mill. Sheds in foreground protect ends from weather prior to midwelding. Since pipe is never stock piled welders receive joints in perfect condition.



REPUBLIC ALLOY STUDS are widely used in the oil and gas industry. We make and stock over 20,000 regular items for all fastening needs. Clean, accurate threads provide maximum holding power, resistance to wear and trouble-free backoff for maintenance. Specify Republic fasteners on your next order.

•

REPUBLIC CHAIN (right) has secured many a load of casing and line pipe for trucking to the job site. Republic's Chain Division makes a complete line of chains in a wide range of sizes for every requirement—from binding, hauling, hoisting and towing to tire chains and chain slings. Coast-to-coast warehousing assures prompt delivery.

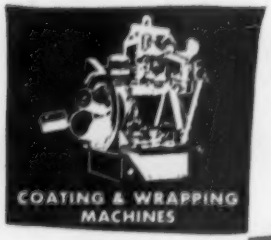
STEEL

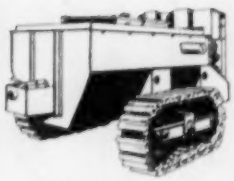
and Steel Products

REPUBLIC STEEL CORPORATION
Dept. C-2759
3112 East 45th Street
Cleveland 27, Ohio

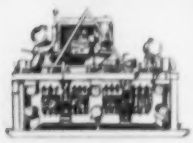
Please send me information on:
Republic Line Pipe:
☐ Electric Resistance Weld ☐ Republic Chain
☐ Electric Fusion Weld ☐ Republic Fasteners
☐ Continuous Butt Weld

Name_____ Title_____
Company_____
Address_____
City_____ Zone____ State_____


COATING & WRAPPING MACHINES


PIPELINE KETTLES

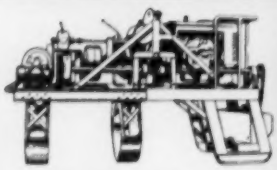
CUTTING & BEVELING MACHINES


STATIONARY CLEANING & PRIMING MACHINES

CROSE

CLEANING & PRIMING MACHINES

THE NAME THAT MEANS EVERYTHING


ROAD BORING MACHINES

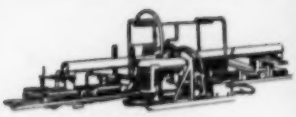
ENDLESS PIPE BELT SLINGS

INTERNAL LINEUP CLAMPS

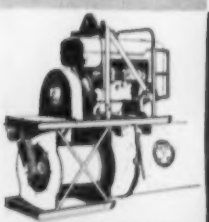
TO PIPELINING

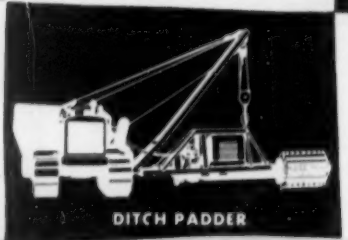
PIPE PREHEATER

PATCH KETTLES


STATIONARY COATING & WRAPPING MACHINES

PIPELINE CRADLES


PIPELINE DEFROSTER


DITCH PADDER

PIPELINE ROLLING RIGS

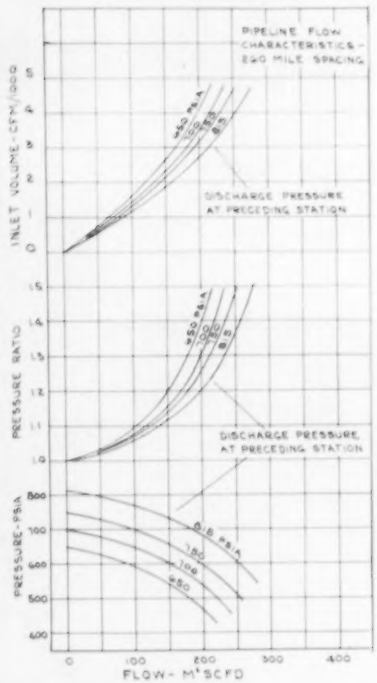
PIPE COUPON CUTTER

m.j. Crose Manufacturing Company, Inc.

2715 DAWSON ROAD • TULSA, OKLAHOMA • PHONE MAdison 6-2172

New York, N. Y. Ph. Bryant 9-2236 • *Denver, Colorado Ph. EMpire 6-0332
*Houston, Texas Ph. UNderwood 9-3358 • *Newark, N. J. Ph. MArket 4-3650
DISTRIBUTOR: *CROSE-CURRAN LTD. — EDMONTON, ALBERTA — PHONE 3-5135
*Warehouses in 4 locations

PIPELINE PATROL



PIPELINE-FLOW characteristics for 260-mile station spacing. Fig. 11.

pressure ratios are substituted and additional compressors are installed. The lower flow limit is determined by diameter limitations of the impeller and also by performance which deteriorates at very low design flows. Fig. 4 *(The Oil and Gas Journal, November 5, 1956, page 137)* shows typical design limits for a given compressor frame size at average pipeline conditions.

The compressor designer usually prefers to describe performance in terms of actual inlet volume, head (work per pound of gas pumped), and efficiency. Pipeline calculations, however, are based on flow in standard cubic feet, pressure ratio, and horsepower. Some manipulation is necessary to obtain compressor characteristics which may be used readily in application studies.

Of the many possible systems of relating compressor performance to pipeline performance, it is believed that the one presented here provides quickly the essential information.

Design points . . . The design points of the pipeline, station spacing, and installed horsepower have been established as shown in Fig. 3 *(The Oil and Gas Journal, October 22, 1956, page 139)*.

Pipeline-flow characteristics are now prepared for station spacings of 32½, 65, 97½, 130, and 260 miles as shown

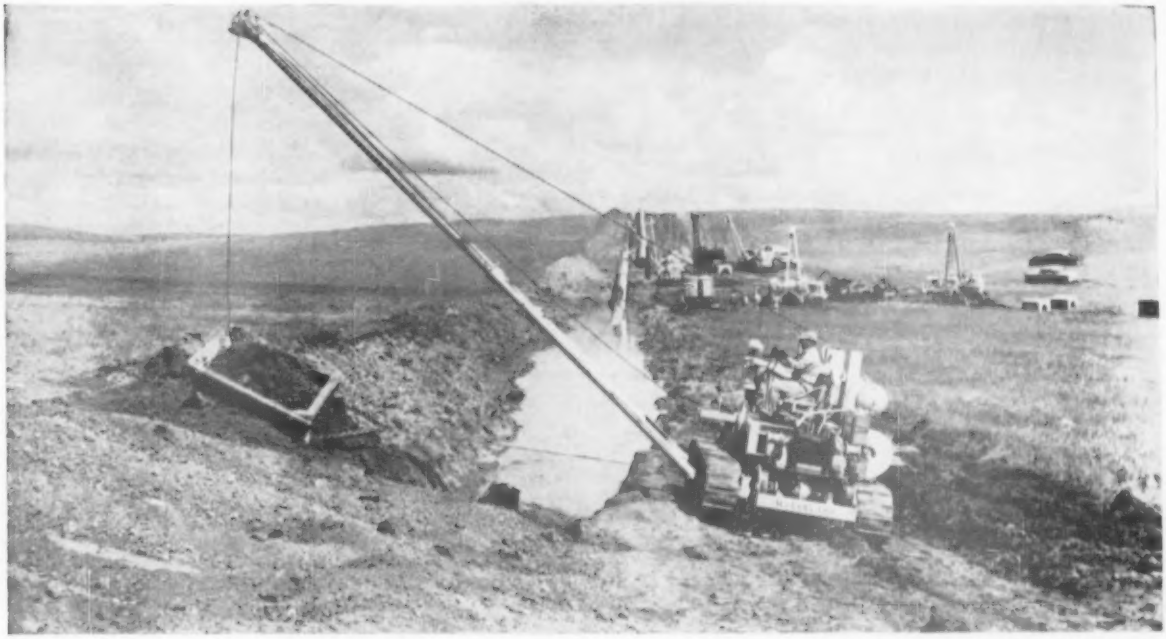


Photo courtesy Trans-Canada Pipe Lines, Ltd.

ON TRANS-CANADA PIPE LINES' 2,250-mile natural gas line, this fast working Cleveland 190 backfiller stays on the heels of the lowering-in gang. Boggy areas such as shown here near Swift Current, Saskatchewan, were frequently encountered. Perfectly balanced on wide, non-packing crawlers, the big 190 licks all types of terrain —swamps, hills, mountains—efficiently backfills heavy and light soils on both large and small diameter lines.

THE CLEVELAND TRENCHER COMPANY, 20100 St. Clair Avenue, Cleveland 17, Ohio

PROTECT OIL AND GAS PIPE LINES with *NICOLET ASBESTOS PIPE LINE FELT*

- NICOLET STANDARD—Perforated or Unperforated.
- NICOLET TUFBESTOS—(Lightweight)
- NICOLET REFLECTO—(White)

All Glass Strand Reinforced

BEST PROTECTS ENAMEL COATINGS

EASILY APPLIED

Asbestos is inorganic. We believe this *inorganic* material, which comprises the major contents of the base felt, provides a longer-lasting shield protection for all pipeline enamel coatings.

Write for your copy of the new Nicolet Catalog

ALL INQUIRIES WELCOME

Photo showing Nicolet Felt Protecting Pipe Line

The Felt With a Future

MANUFACTURED BY:
NICOLET INDUSTRIES, INC.

70 PINE STREET
NEW YORK 5, N. Y.

ARMSTRONG BROS.
Better PIPE TOOLS

PIPE CUTTERS

"ARMSTRONG BROS." Three wheel and Standard wheel and roller Pipe Cutters are quality cutters throughout . . . built to give years of good service.

"ARMSTRONG BROS." drop forged Pipe Cutters are built for lifetime service with 1-piece drop forged steel heat treated body and a replaceable hardened steel nut to take up the wear and thrust of handle screw. Used either as 1-wheel (with 2 roller) or 3-wheel (for close quarters).

"ARMSTRONG BROS." Knife Blade Cutter Wheels are machined from special alloy tool steel properly heat treated. They cut rapidly and easily, hold their keen edge.

Write for Catalog

ARMSTRONG BROS. TOOL CO.
"the Tool Holder People"
5204 W. ARMSTRONG AVENUE • CHICAGO 30, ILL.

Write for Bulletin

PATENTED

PIPELINE VENTS AND MARKERS

FLEET-LINE CO.
P. O. BOX 276-B
SHREVEPORT
LOUISIANA

the lifetime of the Coating is the lifetime of . . .

OWENS-CORNING
FIBERGLAS
COROMAT

. . . a flexible mat, made from glass fibers bonded with an elastic resin, reinforces enamel on underground pipe. Coromat adds strength, where strength is needed, to the coating during application and in service.

MIDWESTERN
PIPE LINE PRODUCTS CO.
Box 1856 Tulsa, Oklahoma

PIPELINE PATROL

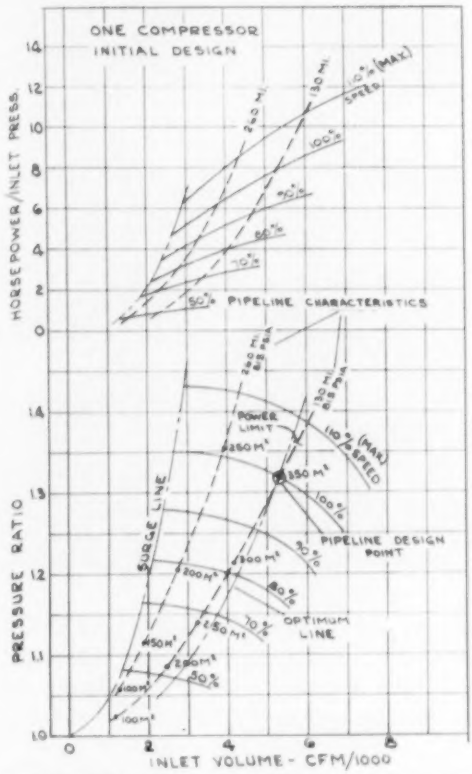
in Figs. 5, 8, 9, 10, and 11. *(Figs. 5 and 8 appear in The Oil and Gas Journal, November 5, 1956, pages 137 and 138.)* These curves show station suction pressure, station pressure ratio, and actual inlet volume versus flow in standard cubic feet for several different discharge pressures from the preceding station.

Referring to Fig. 3 and also to the indicated pipeline-design points in Figs. 5, 8, and 10, compressor requirements may be tabulated for the design points of the pipeline as shown in Table 3.

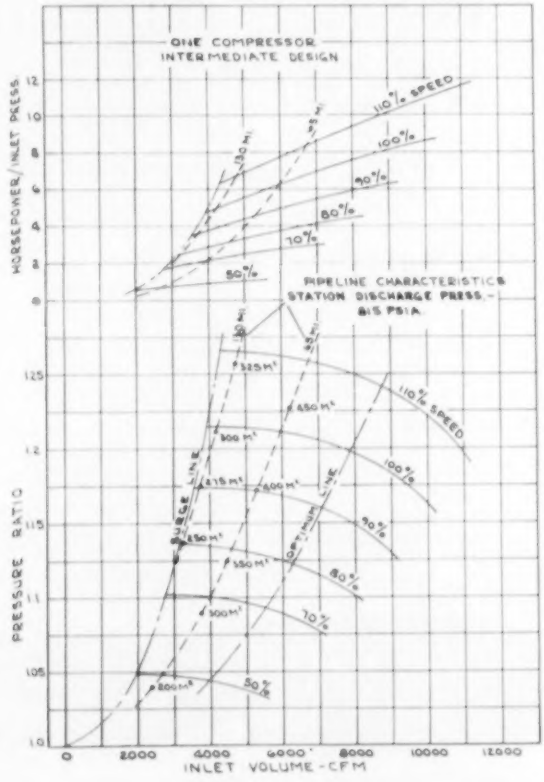
Different impellers and diffusers will be necessary for each condition.

Characteristics . . . Compressor characteristics are selected for each operating condition, plotted in terms of actual inlet volume, pressure ratio, and horsepower divided by inlet pressure. Fig. 12 shows the compressor characteristic for the initial condition, where one unit per station is used.

Fig. 13 shows the performance of one of these compressors operating alone.



COMPRESSOR CHARACTERISTICS for the initial condition. Fig. 12.



PERFORMANCE for one compressor of intermediate design. Fig. 13.

MAGNESIUM for cathodic protection

DOW

A sample of every melt is rushed to the lab for spectrographic analysis via a pneumatic tube similar to those in department stores.

Spot check? No sir—Each Magnesium Anode is

QUALITY CONTROLLED

Quality control is no idle phrase at Dow's Madison, Illinois, mill. Every magnesium anode produced there meets rigid production requirements before it goes out into the field. And because quality is consistently high, users of Dow magnesium anodes get consistent results in terms of better cathodic protection.

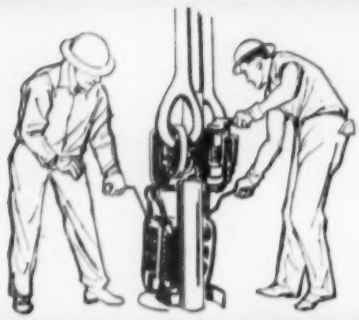
Here's how it works: A sample of every melt is analyzed by spectrograph before pouring. The sample is dispatched to the lab by means of a pneumatic tube system. An immediate check is made and results are phoned back to the foundry before the O.K. to pour is given.

More effective protection. All this adds up to more effective, more dependable protection. Any of the Dow anode distributors listed below can show you big savings for your specific applications. Call one today. THE DOW CHEMICAL COMPANY, Dept. MA 379Q, Midland, Michigan.

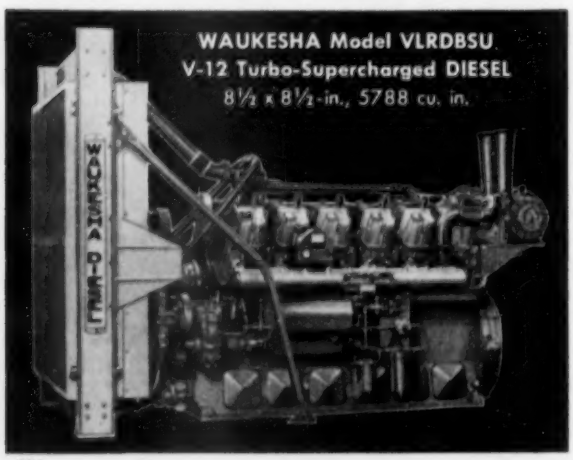
CALL THE DISTRIBUTOR NEAREST YOU: Cathodic Protection Service, Houston, Texas • Corrosion Services, Inc., Tulsa, Oklahoma • Electro Rust-Proofing Corp. (Service Division), Belleville, N. J. • Ets-Hokin & Galvan, San Francisco, Calif. • Royston Laboratories, Inc., Blawnox, Penna. • Stuart Steel Protection Corp., Plainfield, N. J. • The Vanode Co., Pasadena, Calif.

you can depend on DOW MAGNESIUM ANODES

DOW



Brewster-Bartle Drilling Co. Inc. use WAUKESHAS on "Trinity Bay" inland barge on South Louisiana coast



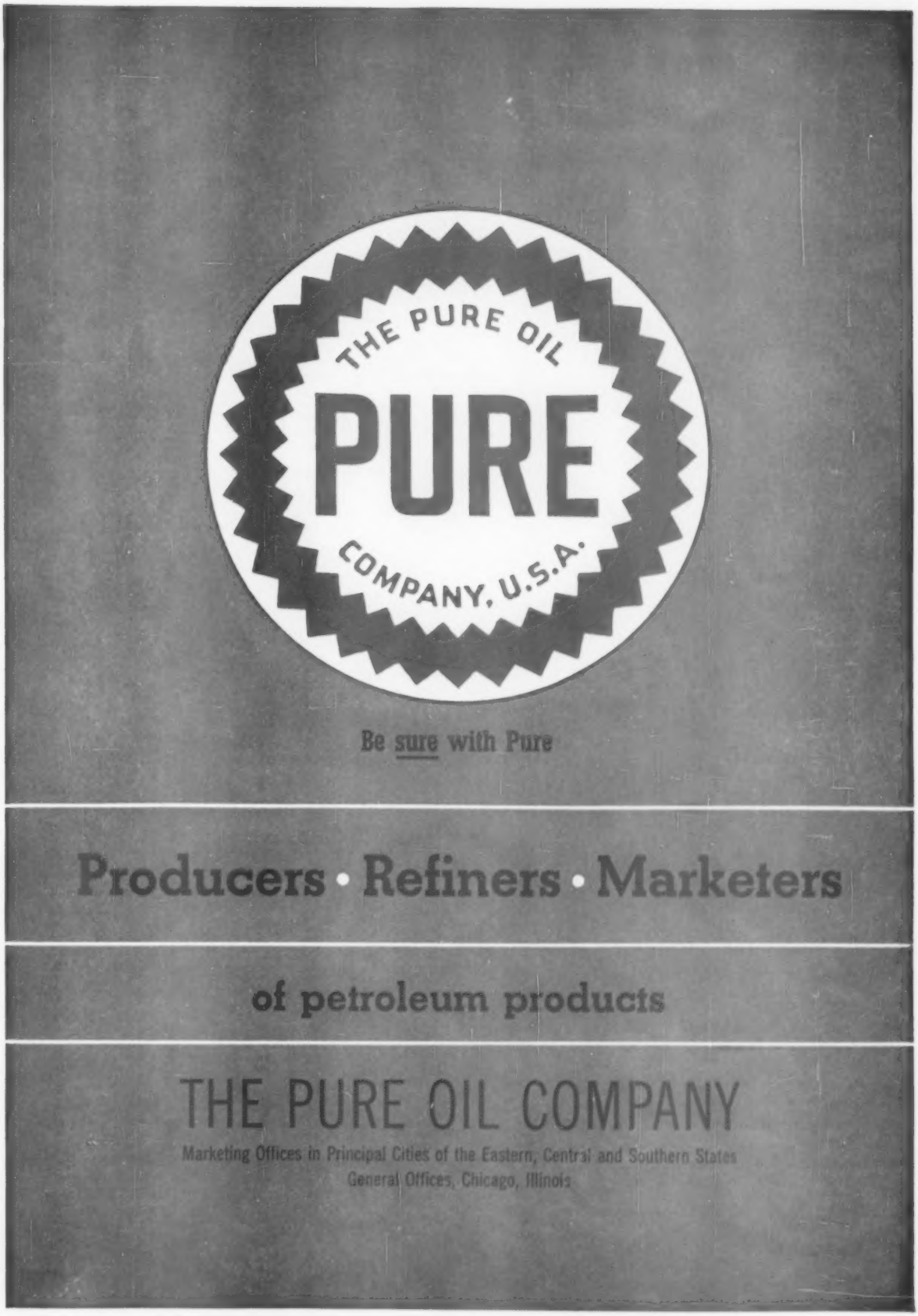
● Three VLRDBSU Waukeshas do the drilling and pumping here. They're big ... and equipped with exhaust-driven dual turbo-chargers for extra power that's extra-smooth. Rugged for heavy duty, but compact ... and yet simple in design for complete reliability with high fuel economy and low upkeep. They're 12-cylinder, 60-degree vee, four-cycle, 5788 cu. in. full Diesels with counterbalanced crankshafts. Send for Bulletin 1663.

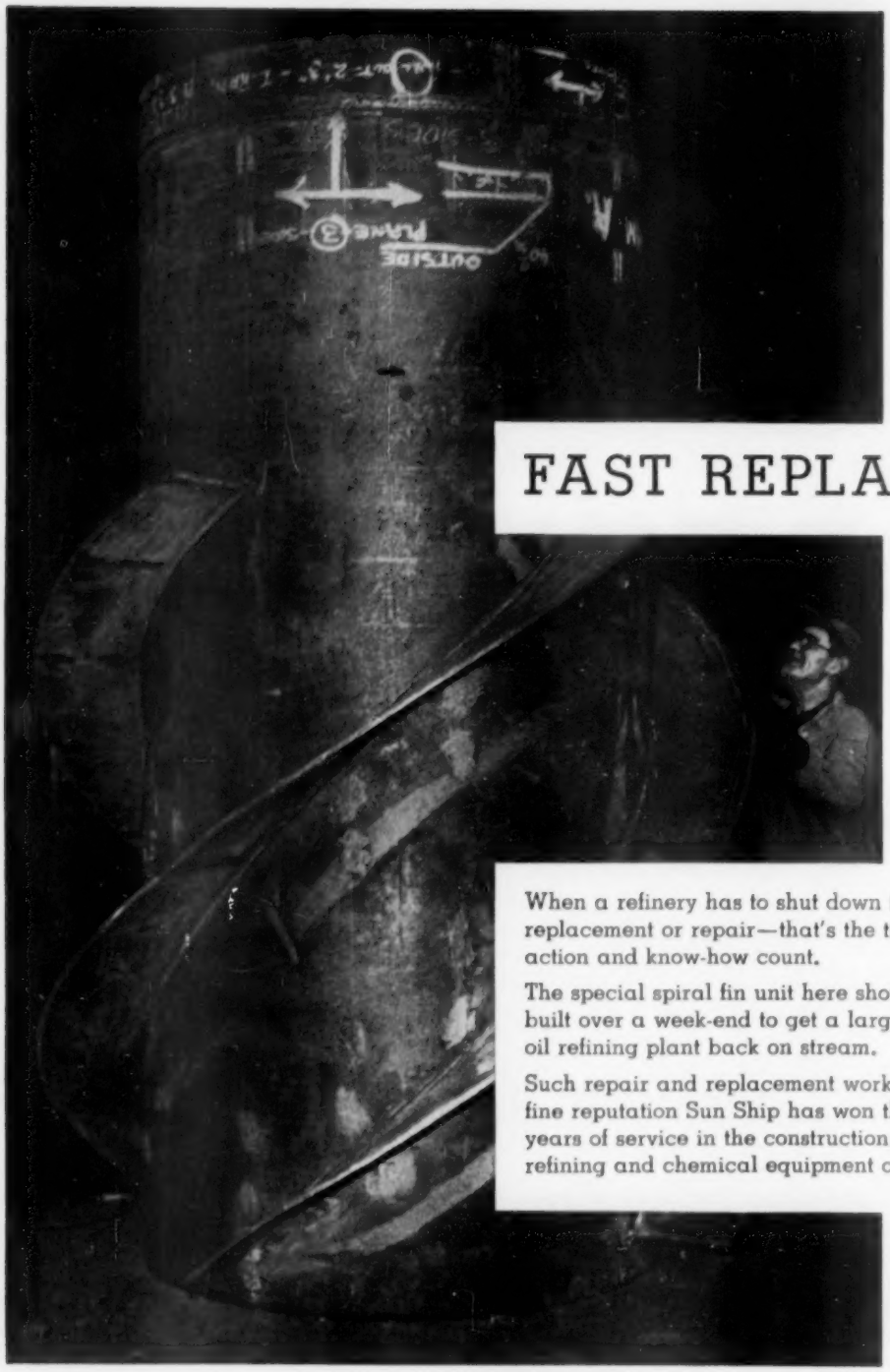
For lighting and auxiliary power there are two Waukesha WAKDB 100 KW Enginators. These accurately balanced, conservatively rated Waukesha Diesel engine-driven generator combinations supply a smooth, steady flow of power for continuous duty. Other Waukesha Enginators in capacities from 600 to 50 KW. Send for Bulletins.

324

WAUKESHA

WAUKESHA MOTOR COMPANY, WAUKESHA, WISCONSIN • NEW YORK • TULSA • LOS ANGELES


THE PURE OIL
PURE
COMPANY, U.S.A.
Be sure with Pure
Producers • Refiners • Marketers
of petroleum products
THE PURE OIL COMPANY
Marketing Offices in Principal Cities of the Eastern, Central and Southern States
General Offices, Chicago, Illinois



FAST REPLACEMENT

When a refinery has to shut down for a replacement or repair—that's the time when action and know-how count.

The special spiral fin unit here shown had to be built over a week-end to get a large oil refining plant back on stream.

Such repair and replacement work has added to the fine reputation Sun Ship has won through years of service in the construction of oil refining and chemical equipment of every kind.

Sun

SHIPBUILDING & DRY DOCK COMPANY

ON THE DELAWARE (SINCE 1916) CHESTER, PA.

ANNOUNCING
a new oilfield distributor for Kaiser Aluminum petroleum pipe

Republic Supply Company...
Dunigan Tool & Supply Company... and now—
another distributor to provide immediate delivery of Kaiser Aluminum Petroleum Pipe

Oil Well Supply
Division United States Steel Corporation

Three distributors can now supply you with high quality Kaiser Aluminum pipe in 20, 30 and 40-foot lengths of 2, 2½, 3 and 4-inch sizes, with cladded inside surfaces to resist corrosion.

Durable Kaiser Aluminum pipe is ten times lighter than schedule 40 steel pipe... 40 feet of the 4" aluminum pipe is easily handled by only one man.

Actual installations prove that because of its lightweight and easy handling, Kaiser Aluminum pipe will save you up to $84.35 per mile in loading, stringing and handling.

And, you get extra savings when you use economical Kaiser Aluminum pipe—with your choice of aluminum couplers—for rig supply line systems. The newly developed detachable couplers speed connecting and break-out time to give you an additional saving of about $1.35 per mile.

Remember, the *roll-formed* aluminum petroleum pipe available only from Kaiser Aluminum assures closer diameter and wall thickness tolerances—factors which every experienced pipeliner knows are so important for leak-proof coupler fit or welding line-up.

For immediate delivery from warehouse stocks or for more information, contact any distributor shown below; or, call the Kaiser Aluminum sales office listed in your telephone directory. Kaiser Aluminum & Chemical Sales, Inc., *General Sales Office*, Palmolive Bldg., Chicago 11, Ill.; *Executive Office*, Kaiser Bldg., Oakland 12, California.

Kaiser Aluminum **Petroleum Pipe**

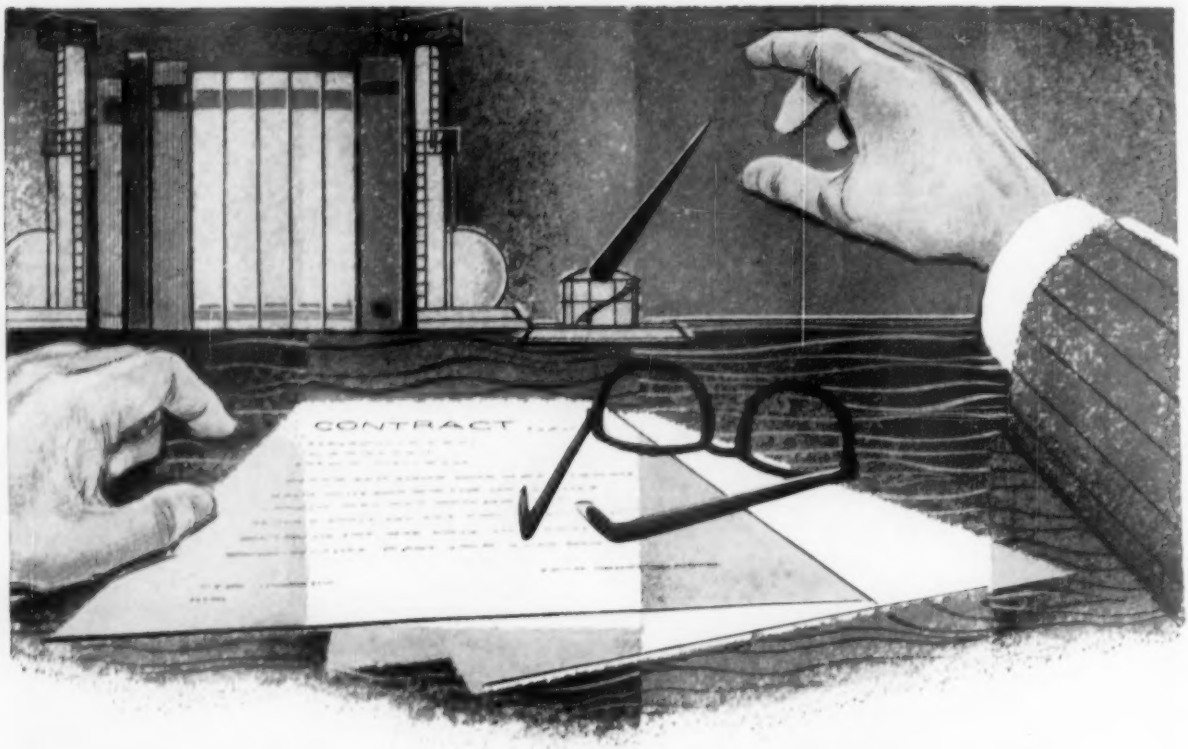
distributed by

REPUBLIC SUPPLY COMPANY
Republic Building
Oklahoma City
Oklahoma

DUNIGAN TOOL & SUPPLY COMPANY
1534 South
Treadway
(Home Office)
Abilene, Texas

"Oilwell" OIL WELL SUPPLY
Division
United States
Steel Corporation
(Home Office)
Dallas, Texas

See "THE KAISER ALUMINUM HOUR." Alternate Tuesdays, NBC Network. Consult your local TV listing.



The easiest way in the world for you to
. . . avoid turnaround trouble!

All too frequently your need for a turnaround isn't revealed until there's an operational failure. Yet it is so easy to avoid the excessive costs and inconvenience of sudden, unplanned shut-downs.

Simply contract with Procon for a schedule of turnaround maintenance. Then your downtime can be economically planned in advance and one of Procon's experienced turnaround crews will overhaul your unit expertly and get it back on stream in the shortest possible time.

Procon men are specialists on turnarounds. We are doing more of them than any other construction firm. Our experience can provide a time-and-money saving answer to your turnaround problems. We will be glad to give you full information about it any time.

PROCON *Incorporated*
1111 MT. PROSPECT ROAD, DES PLAINES, ILLINOIS, U.S.A.

PROCON (*Canada*) LIMITED
TORONTO 18, ONTARIO, CANADA

PROCON (*Great Britain*) LIMITED
LONDON, W. C. 2, ENGLAND

WORLD-WIDE CONSTRUCTION FOR THE PETROLEUM, PETROCHEMICAL, AND CHEMICAL INDUSTRIES

REPUBLIC HOSE *in stock* in J & L Stores!

ARKANSAS
El Dorado

COLORADO
Rangely, Sterling

ILLINOIS
Carmi, Clay City, Salem, St. Elmo

KANSAS
Chase, El Dorado, Great Bend, Hill City, McPherson, Russell, Winfield

KENTUCKY
Henderson, Paintsville

LOUISIANA
Bunkie, Harvey, Haynesville, Houma, Lafayette, Lake Charles, Rodessa, Shreveport

MICHIGAN
Mt. Pleasant

MISSISSIPPI
Brookhaven, Laurel, Natchez, Oil City

MONTANA
Cut Bank, Glendive

NEW MEXICO
Hobbs

NEW YORK
Bolivar

NORTH DAKOTA
Williston

OHIO
Canton

OKLAHOMA
Bartlesville, Cushing, Duncan, Healdton, Lindsay, Nowata, Oklahoma City, Okmulgee, Perry, Seminole, Shidler, Tulsa

PENNSYLVANIA
Bradford, Clarion

TEXAS
Alice, Anson, Ballinger, Beaumont, Best, Big Spring, Borger, Corpus Christi, Electra, Freer, Gladewater, Graham, Houston, Kermit, Kilgore, Longview, Luling, Mexia, Midland, Muenster, Odessa, Overton, Pampa, Pleaston, Sherman, Snyder, Sundown, Talco, Victoria, Wichita Falls

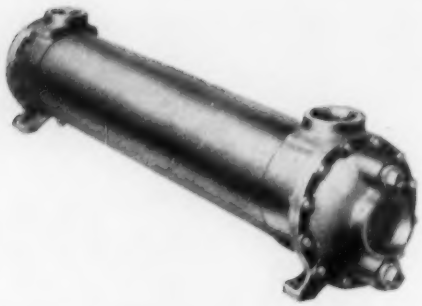
WEST VIRGINIA
Clarksburg

WYOMING
Casper, Newcastle, Powell, Worland

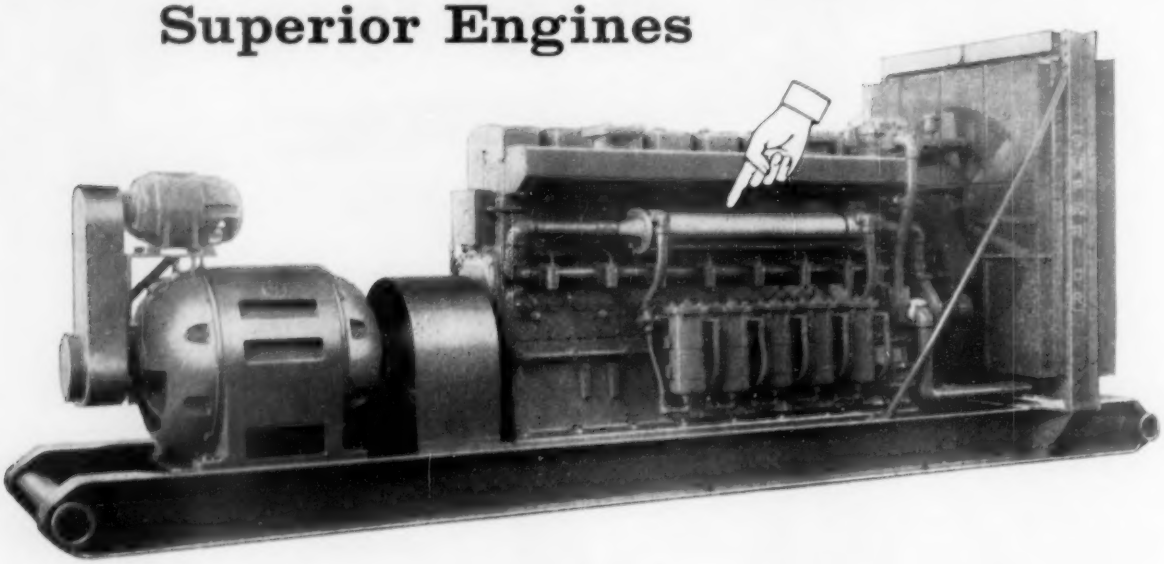
Stocked in the Mid-Continent Area by JONES & LAUGHLIN SUPPLY DIVISION
P.O. Drawer 2481, Tulsa 2, Okla.
and the J & L Store in YOUR field.

REPUBLIC RUBBER DIVISION
LEE RUBBER & TIRE CORPORATION, YOUNGSTOWN 1, OHIO
INDUSTRIAL RUBBER PRODUCTS

Stocked on the West Coast by
HENDRIE BELTING & RUBBER CO
405 Towne Ave., Los Angeles, Calif.
PACIFIC COAST RUBBER COMPANY
51 Main St., San Francisco, Calif.



ROSS EXCHANGERS
hold lube oil at proper temperature in Superior Engines



Powering pumping motors, this 8-cylinder Superior Engine Generator Set is one of six on duty at a lease operated by a major oil company in Wyoming.

To protect close clearance parts by keeping lube oil at the *right* temperature and viscosity, each engine is equipped with a Ross Type BCF Exchanger. Efficient, dependable cooling is assured!

Regularly installed to safeguard the performance of numerous types and makes of prime equipment serving oil fields, pipe lines and refineries, Ross Exchangers are unequaled for ruggedness and thermal efficiency. Pre-engineered and fully standardized, they're available in a wide range of sizes for cooling oil, water, air, gas and hydraulic fluid.

For detailed information, request Bulletin 1.1K5. Ross Heat Exchanger Division of American-Standard, Buffalo 5, N. Y. In Canada: American-Standard Products (Canada) Limited, Toronto 5, Ont.

ROSS

ROSS HEAT EXCHANGER PRODUCTS

BIG INCH OR LITTLE INCH

You get automatic low-cost application when you specify high-quality Polyken

HOW IS THIS POSSIBLE? Factory controlled production from controlled materials—the source of quality—is likewise the source of low-cost field application.

By transferring your coating production *to our plant*, you get:

1. *Polyken* "Controlled Strength"—careful control in the selection and mass processing of raw materials to assure you "all work—no waste";
2. Uniform composition, thickness and adhesion;
3. Application right from the roll—little handling, no heat, no thinners, no solvents, no drying, no cooling, no cleanup time required;
4. High-speed, low-labor power taping for "big inch" as well as "little inch" installations;
5. Lowest equipment investment and manpower costs.

We can't figure your costs here in dollars and cents. But show us your plans—and we suspect you'll be surprised at how little this method costs you.

Let's talk it over now. Write, wire or phone today. The Kendall Company, Polyken Sales Division, Department OG-K, 309 W. Jackson Blvd., Chicago 6, Illinois (Randolph 6-4250).

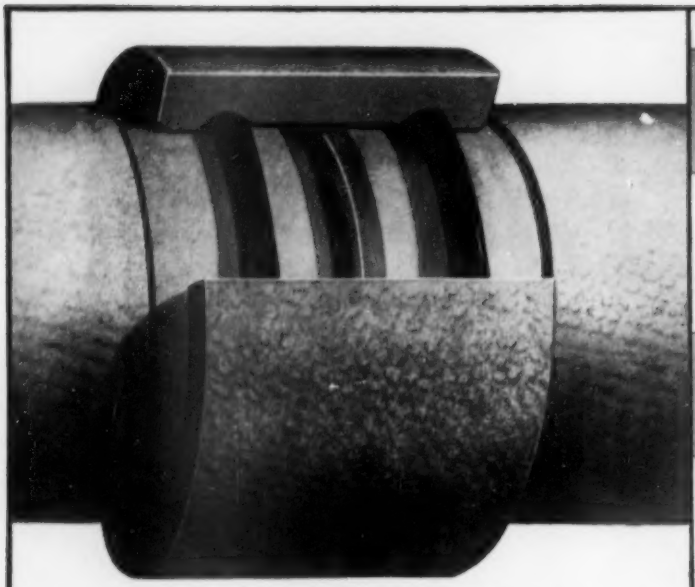
Complete catalog, Sweet's Industrial Construction File, Sec. 13c

Polyken®

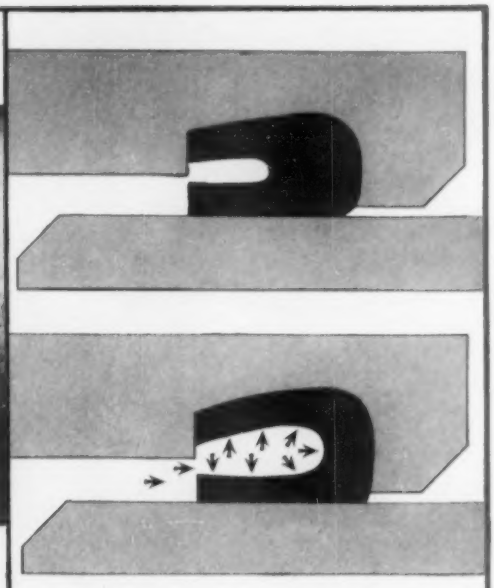
CONTROLLED STRENGTH

PROTECTIVE COATINGS

THE KENDALL CO., POLYKEN SALES DIVISION



"CENTURY" ASBESTOS-CEMENT "FLUID-TITE" COUPLING (sectioned). Make-up speed results from holes in tapered "Fluid-tite" sealing rings. Holes permit rings to compress, allowing pipe ends to slide into coupling easily and without a special puller.



ACTION OF FLUID PRESSURE ON SEALING RINGS. Fluid enters pipe; internal pressure on holes in sealing rings causes rings to expand. The greater the pressure, the tighter the seal.

Three men use a new coupling method to make up "Century" A-C Pipe at the rate of

19 Feet Per Minute in Soggy Mud

A three-man crew recently made up over ¼ mile of six-inch "Century" Asbestos-Cement Pipe in 1¾ hours. Their accomplishment is believed to be a record, especially since the pipe was laid in mud under weather conditions which might ordinarily have washed out the whole operation.

Speed of make-up was made possible by the new "Century" Fluid-tite Coupling. Its special sealing rings are designed to permit easy compressibility, allowing pipe ends to slide into the coupling without special equipment. Contracted during installation, the rings expand when fluid enters the line. The higher the pressure, the tighter the seal.

Lightweight "Century" A-C Pipe with Fluid-tite Couplings can be positioned and made up in the field with minimum crews. Except for the largest diameters, no coupling pullers are necessary.

"Century" pipe itself offers all the tested qualities of Asbestos-Cement for oil country use. It is non-corrosive and non-tuberculating. This, plus its exceptional strength, has long made "Century" pipe the oilman's choice for carrying salt water, sour crude and fresh water, especially in areas of selective corrosion.

Write today for Bulletin No. A-C 456 giving full details on the new Fluid-tite Coupling. You will also receive a free copy of the Asbestos-Cement Pipe Flow Chart, hole punched on heavy board for your notebook.

© 1956

SOUTH CHESTER TUBE COMPANY

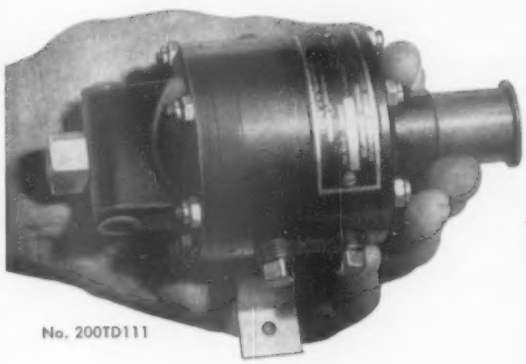
1418 SOUTH PENN SQUARE, PHILADELPHIA 2, PA.

Fort Worth 2, Texas
1605 Oil and Gas Bldg.
Phone: EDison 2-8871

Houston 2, Texas
420 Esperson Bldg.
Phone: FAirfax 3-1153

Tulsa 3, Oklahoma
Hunt Building
Phone: CHerry 2-1284

"That new Taylor Instrument's saving us money already!"



No. 200TD111

He's talking about the new Taylor low-cost Flow Transmitter!

THE reason he can spot the savings so quickly is that the No. 200TD111 Fixed Range Differential Pressure Transmitter is being used to measure departmental consumption of steam, air and water that previously went unchecked. That 3-pen recorder in the background shows at a glance how much is being used by a given department as a basis for apportioning costs. It's the remarkably low price of this new instrument that makes it such a practical cost accounting aid on applications hitherto considered marginal.

Measuring only 6½" x 3" and weighing only 4½ lbs., its simplified piping, force-balance construction and external adjustments make it easy to install and maintain. Calibration accuracy is better than 1%. Sensitivity exceeds 0.1%. Ranges 0 to 50, 100, 200 and 300 inches of water. Built for rough service and outdoor mounting.

Call your Taylor Field Engineer, or write for **Bulletin 98274.** Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada.

DESIGN SPECIFICATIONS

Diaphragm of Neoprene-impregnated Nylon.
Body material, brass.
Maximum working pressure: 150 psi.; temperature 150°F.
Air Supply pressure, 20 psi.
Air consumption, 0.10 standard cu. ft. per minute.
Output pressure range 3 to 15 psi.
Size 6½" x 3". Weight 4 lbs. 9 ozs.
All connections ¼" internal NPT.

Taylor Instruments
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY

SPECIFICATIONS . . . Closing time: 0.1 second
Leakage: 0 Volume flow: over 40,000 s.c.f.m.
Inlet pressure: over 3,000 psig
Temp. range: +400° F. to −300° F.
Size: inlet dia. 2" — outlet dia. 8" — length 18"
Downstream pressure regulated up to 300 psig
Pressure regulation maintained within 1% of setting
Downstream pressure programmed with timing motor

AiResearch valves solve special industrial problems

Petroleum Industry Applications
Chemical Industry Applications
Rocketry Applications
Nuclear Energy Applications

Recent scientific and engineering advances have multiplied the needs for valves and controls with critical operating characteristics.

AiResearch has fifteen years of experience in the engineering and fabrication of specialized valves of all types. We can solve problems which include the handling of liquid nitrogen, liquid oxygen and pressurized helium under rigorous extremes of heat, cold and other environmental conditions. The valve illustrated, developed for a rocketry application, is an example of our capabilities in this field.

If you have a problem involving specialized valves, we invite you to contact us.

THE GARRETT CORPORATION

AiResearch Industrial Division

9225 South Aviation Blvd., Los Angeles 45, California

DESIGNERS AND MANUFACTURERS OF TURBOCHARGERS AND SPECIALIZED INDUSTRIAL PRODUCTS

The top men at IX who supervise your seismic surveys have a total of 152 man years of experience . . . an average of almost 20 years per person.

Experience

is the priceless ingredient that goes into every IX survey

The personnel of Independent Exploration Company has packed more than 1,559 man years of experience into the company's quarter century of service to the oil industry. That's why Independent Exploration Company can offer you the tops in fast, accurate, informative geophysical surveys. Next time call in IX for a better job.

POINTING THE WAY IXC FOR THE DRILL

Independent Exploration Company

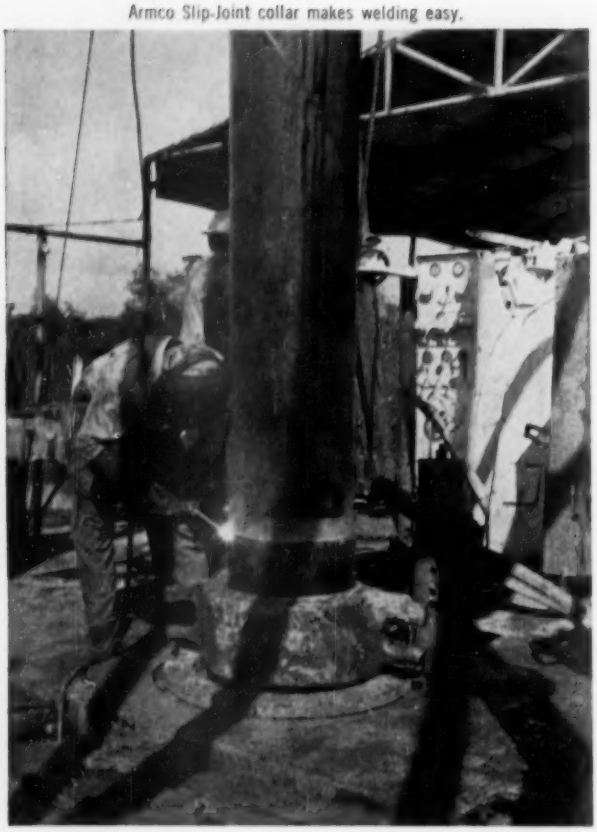
1973 West Gray, Houston, Texas
16 Coleman St., London E.C.2, England
1740 Broadway, Room B-232, Denver, Colorado

Geophysical Surveys

OVER 1,559 MAN YEARS OF EXPERIENCE

THIS COLLAR
Helps you get Armco Casing down the hole...FAST

Armco Slip-Joint collar makes welding easy.



The Armco Slip-Joint Collar speeds running time. Just stab the end of the next joint into the collar, make a quick weld and the string is ready to lower.

Line-up and stabbing are fast and easy with the uniformly round diameter and square cut ends of Armco Casing. And there are no threads to cut into the casing wall.

Armco Casing offers you many other advantages: You can select the exact size you need from the wide range of diameters (6 to 24 inches) and wall thicknesses ($^3/_{16}$ to $^1/_2$ inch) available in Armco Casing. Long, 40-foot lengths mean fewer joints to handle and weld.

Armco Slip-Joint Casing is distributed by National Tank Company from 25 stocking points conveniently located throughout the oil country. Chances are one of these stocking points is near you.

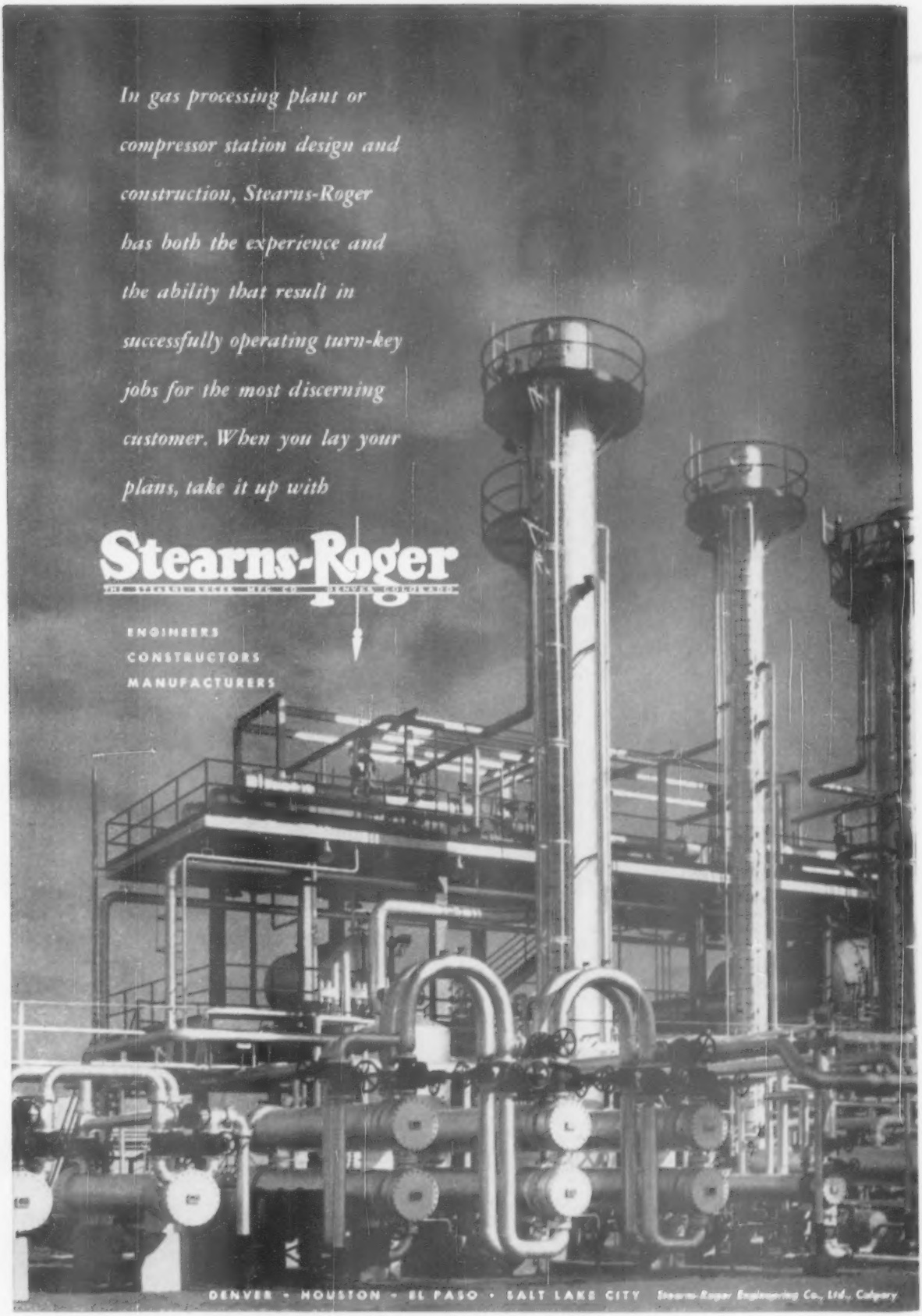
Write to us for more data. Armco Drainage & Metal Products, Inc., Welded Pipe Sales Division, 5066 Curtis Street, Middletown, Ohio. 201 KOME Building, Tulsa, Oklahoma. Subsidiary of Armco Steel Corporation. Export: The Armco International Corporation.

Armco Slip-Joint Casing

Distributed by National Tank Company, Tulsa, Oklahoma. In Canada: National Tank Company, Ltd., Edmonton, Alberta

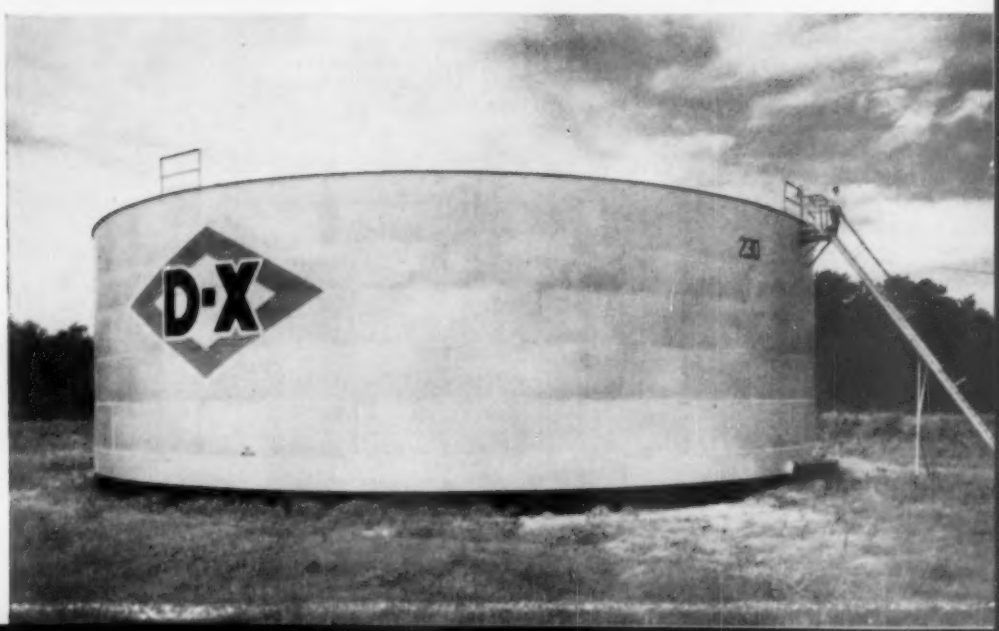
National Tank Company Stocking Points for Armco Casing. Swift Current, Canada; Williston, North Dakota; Casper, Wyoming; Brush, Colorado; Sidney, Nebraska; Great Bend, Kansas; Liberal, Kansas; Oklahoma City, Oklahoma; Seminole, Oklahoma; Pawhuska, Oklahoma; Hobbs, New Mexico; Pampa, Texas; Lubbock, Texas; Snyder, Texas; Abilene, Texas; Electra, Texas; Odessa, Texas; Corpus Christi, Texas; Houston, Texas; Shreveport, Louisiana; Lake Charles, Louisiana; New Iberia, Louisiana; Harvey, Louisiana; Clay City, Illinois; New Harmony, Indiana.

ARMCO


In gas processing plant or compressor station design and construction, Stearns-Roger has both the experience and the ability that result in successfully operating turn-key jobs for the most discerning customer. When you lay your plans, take it up with
Stearns-Roger
ENGINEERS
CONSTRUCTORS
MANUFACTURERS
DENVER • HOUSTON • EL PASO • SALT LAKE CITY
Stearns-Roger Engineering Co., Ltd., Calgary

COSDEN
gave these 80,000-bbl. tanks a vapor-stopping seal of "Microballoon" spheres in April, 1954, about 4500 lb. per tank. Some 1,500,000 bbl. per year have since been pumped through each tank. Tanks handle sweet crude with a high gravity—about 37 to 45 API. Gas content is 40 to 50 per cent.

SOHIO
has had this five-tank farm equipped with "Microballoon" spheres since October, 1953. Farm capacity is 400,000 bbl., four tanks operating on a seven-day cycle with 7 RVP oil. Fifth handles 4 to 5 RVP on a 23-25-day cycle. Pipeline rate is 40,000 bbl. per day.



D-X SUNRAY
equipped this 35,000-bbl. working storage tank with "Microballoon" spheres two years ago. Pumping or receiving 80 per cent of the time, the tank handles select crude and mixed crude — casinghead gasoline. About 5,000,000 bbl. have been pumped through since the vapor seal was installed.

SINCLAIR is testing this "Microballoon" sphere covered tank along with a control tank, figures a 50 per cent saving. Tank's discharge is 2,000 bbl. per hour with five turnovers per month. Average temperature is 75 deg. F., RVP is 5.6 psi. Now other tanks at this site are due for the vapor-sealing treatment.

Here's where

Microballoon Spheres have*

Cut evaporation for two years

A number of oil companies are now testing evaporation control with "Microballoon" spheres, but the installations on these pages have already been in operation for more than two years. They're still effective—savings up to 80 per cent. Moreover, the tanks are all working tanks, with good turnover.

Figure the savings to your own operations when your cone-roofed tanks are equipped with a vapor seal of "Microballoon" spheres made from BAKELITE Brand Phenolic Resins. For information, write Dept. VK-128.

*Registered trade-mark of The Standard Oil Co. (Ohio)

FOR EVAPORATION CONTROL

BAKELITE
BRAND
RESINS

BAKELITE COMPANY, *A Division of Union Carbide and Carbon Corporation* UCC 30 East 42nd Street, New York 17, N. Y.
In Canada: Bakelite Company, Division of Union Carbide Canada Limited, Belleville, Ontario
The term BAKELITE and the Trefoil Symbol are registered trade-marks of UCC.

When the pressure is on

As a final step in the manufacture of Powell Valves, every valve is subjected to an *actual line test*—a *positive method* of testing. For special services, valves can be given hydrostatic, air and gas tests so that they will meet various fluid control services.

Thus, when the pressure is on *you*—when you have a production schedule that must be met—that's when you'll be glad you installed Powell Valves.

No matter what your flow control problem may be, Powell has valves designed to solve your problem. And you can *depend* on long, trouble-free service. Through careful quality control, *every* Powell Valve has PERFORMANCE VERIFIED.

Because of Powell's painstaking quality control, plant shutdown through valve failure is greatly reduced. Records from refineries, power and industrial plants the world over prove it.

Consult your Powell Valve distributor. If none is near you, we'll be pleased to tell you about our *complete quality line* which has *Performance Verified.*

The Wm. Powell Company
Cincinnati 22, Ohio
. . . 110th YEAR

PERFORMANCE
PV
VERIFIED

FIG. 1561—150-Pound Steel Swing Check Valve

FIG. 1503—150-Pound Steel Gate Valve

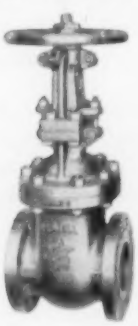
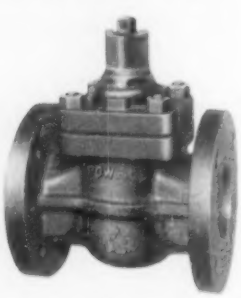
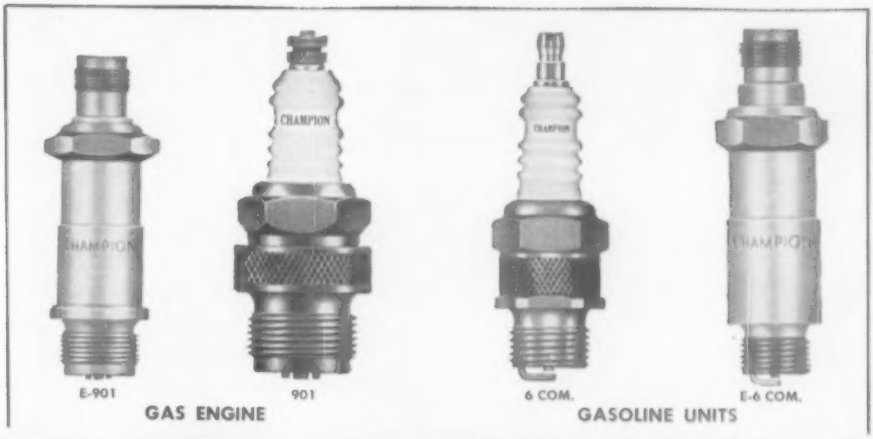


FIG. 2201—175-Pound W.O.G. Semi-Steel Lubricated Plug Valve

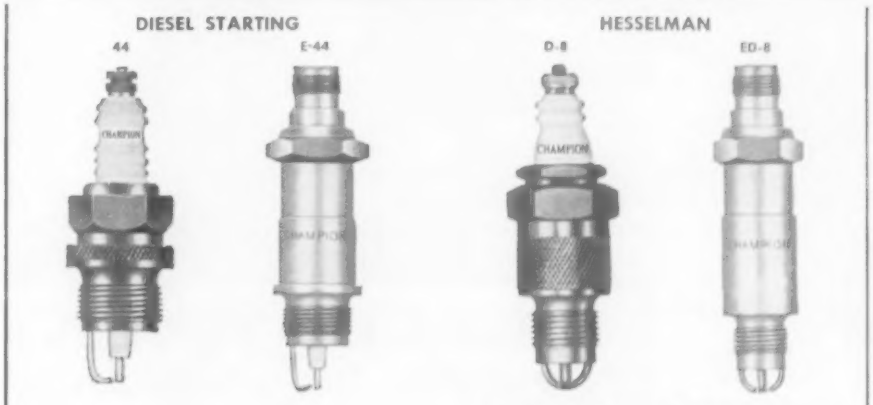


Bronze, Iron, Steel and Corrosion-Resistant Valves

POWELL VALVES



For better performance
in every industrial
and oil field engine
specify dependable
CHAMPION SPARK PLUGS!



BEST FOR ANY ENGINE

CHAMPION

SPARK PLUGS

CHAMPION SPARK PLUG COMPANY, TOLEDO 1, OHIO

SERVICE
makes the difference!

What makes Mid-Continent the world's largest independent oil field supply company?

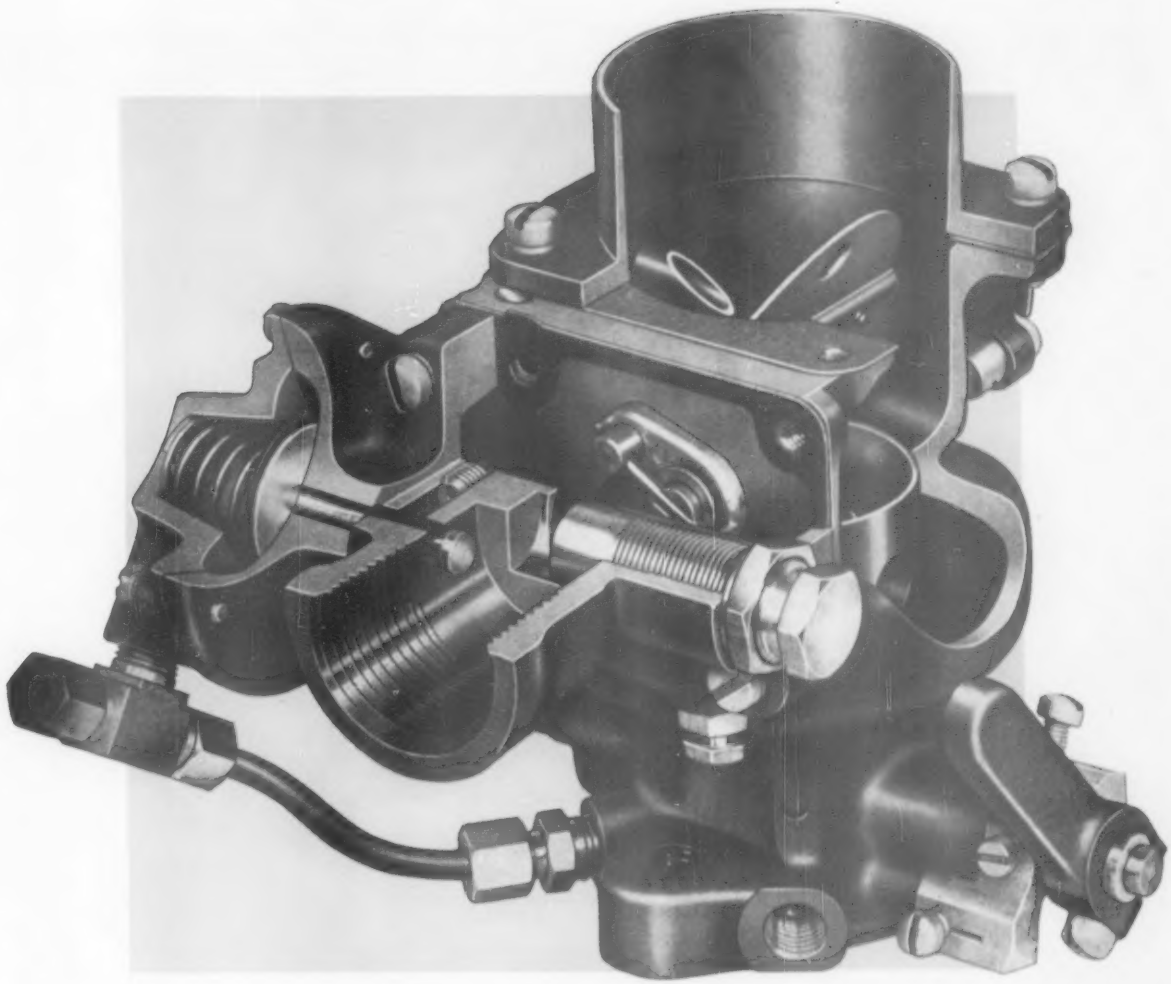
Is it modern facilities like two-way radio network? Is it top lines of equipment like Emsco slush pumps and Unit Rig drawworks? Is it the advanced design of Mid-Continent rig drives?

Yes, it is all of these things. But most of all Mid-Continent's growth and progress is built on SERVICE . . . fast, efficient, friendly service by experienced men who understand your needs and oil field supply problems.

Discover the difference in Mid-Continent service. Call our nearest Store or sales office . . . day or night.

WORLD'S LARGEST INDEPENDENT OIL FIELD SUPPLY COMPANY

MID-CONTINENT
Supply Company
MID-CONTINENT BLDG. • FORT WORTH, TEXAS



On America's finest gas engines... ENSIGN

Model Xg in Up-Draft position showing air cleaner elbow.

- Built-in fixed orifice economizer.
- Instant starting. Utilizes separate set of adjustable gas-air orifices.
- Provisions for balancing air-fuel ratios against air entrance losses.
- Interchange venturi to meet wide range of engine operating conditions.
- Made in 1¼, 1½, 1¾ and 2" SAE Sizes.

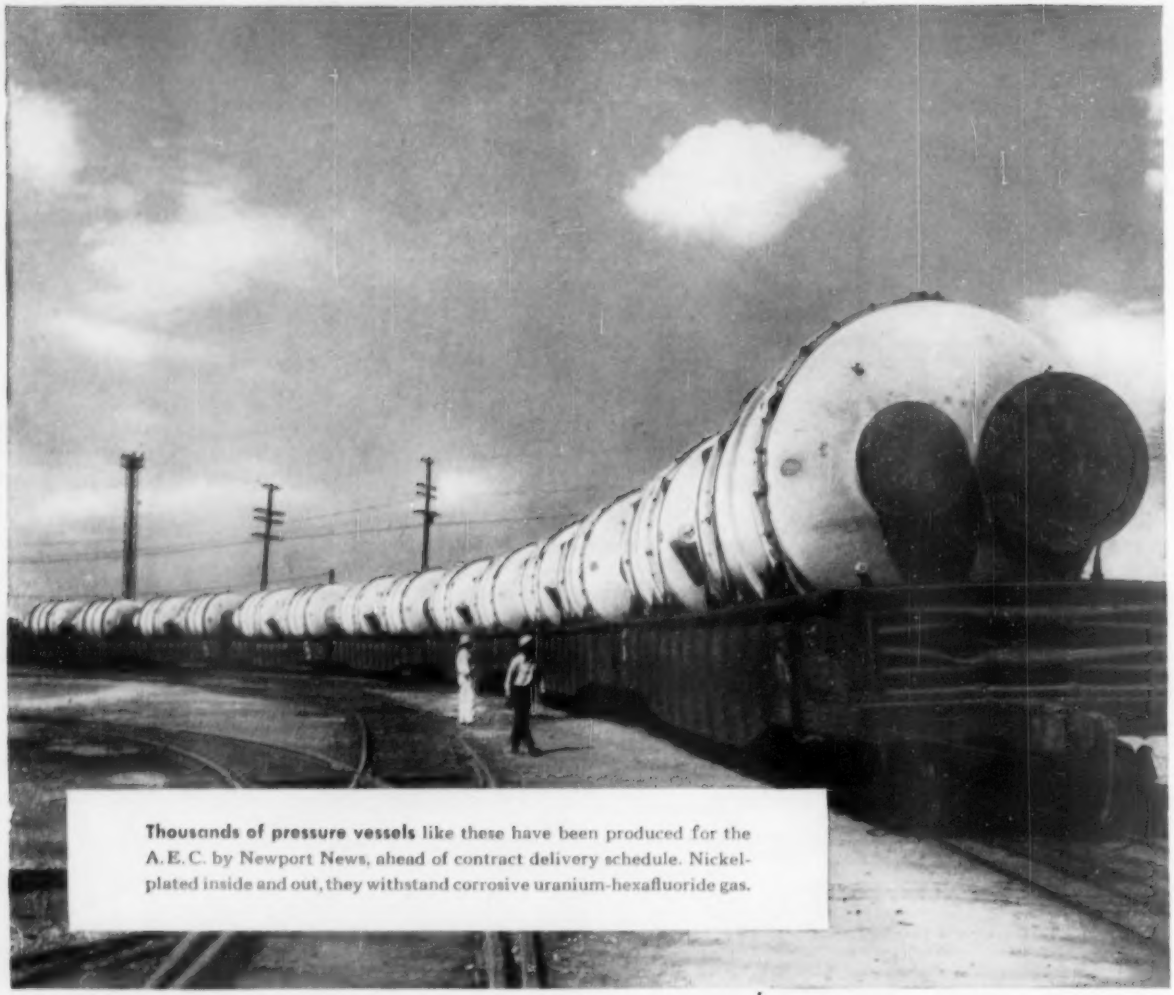
Pictured here is the culmination of 45 years of carburetor experience—ENSIGN'S Model Xg Gas Carburetor for Natural and LP-Gas engines.

Every part of this carburetor—every contour is carefully designed to achieve certain results, the combination of which spells Easy Starting, Rapid Acceleration, Smooth Idle, Full Power and Economy. But most important, is the ability of this carburetor to perform consistently throughout the entire life of the engine. DEPENDABILITY—that's what the name ENSIGN on a carburetor stands for. Insist on ENSIGN—accept nothing less.

For complete details of all Ensign equipment send for Catalog #108.

ENSIGN CARBURETOR COMPANY

1551 E. Orangethorpe, Fullerton, California
Branch Factory: 2330 W. 58th Street, Chicago, Illinois



Thousands of pressure vessels like these have been produced for the A.E.C. by Newport News, ahead of contract delivery schedule. Nickel-plated inside and out, they withstand corrosive uranium-hexafluoride gas.

When the pressure's on for pressure vessels

Specialized production techniques and the skill of Newport News craftsmen operating vast fabricating shops team up to deliver trainloads of pressure vessels on schedule.

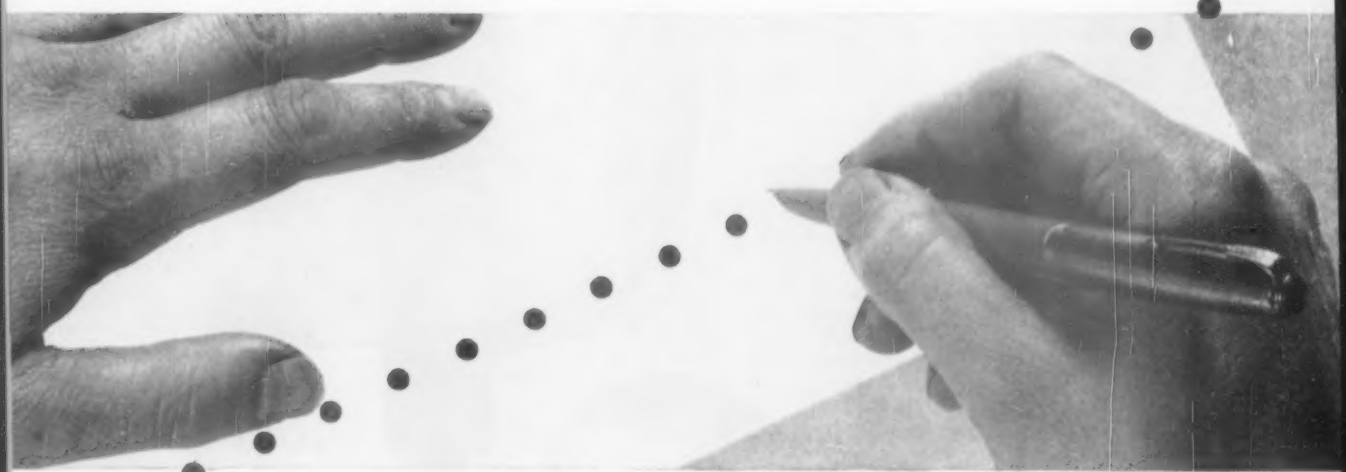
When it comes to turning out process equipment, Newport News has the facilities and experience. So get a bid from Newport News on your present or future projects. Get the benefit of plant methods developed by specialists producing pressure vessels, vacuum tanks, towers, reactors, weldments and sub-assemblies.

Look over the scores of ways in which Newport News can help you . . . send for the easy-to-read, illustrated booklet *Facilities and Products*. It's yours for the asking.

Engineers: Desirable positions available at Newport News for Designers and Engineers in many categories. Address inquiries to Employment Manager.

Newport News
Shipbuilding and Dry Dock Company
Newport News, Virginia

Before you sign your new contract for caustic soda



Right now is the time—before you make your new contract commitments—to carefully review the form of caustic soda you plan to buy.

If you have been buying flake or solid, you may find it a profitable move to switch to liquid.

On the other hand, if you have been buying 50% liquor, you may save substantially by converting to 73% concentration.

Naturally, your location and the volume of caustic soda you use will affect how much your savings may be. But only an up-to-date analysis can tell. Changes in freight rates or changes in your own operation in recent years may have altered drastically the most economical form of caustic for you.

So, before you make your new commitments, consult Columbia-Southern's Technical Service Department. A staff member will be assigned to review the whole picture and to help you determine the most advantageous form of caustic soda you should buy.

Write, wire or telephone our Pittsburgh office today.

COLUMBIA-SOUTHERN CHEMICAL CORPORATION

SUBSIDIARY OF PITTSBURGH PLATE GLASS COMPANY

ONE GATEWAY CENTER · PITTSBURGH 22 · PENNSYLVANIA

DISTRICT OFFICES: Cincinnati • Charlotte
Chicago • Cleveland • Boston • New York
St. Louis • Minneapolis • New Orleans • Dallas
Houston • Pittsburgh • Philadelphia
San Francisco

IN CANADA: Standard Chemical Limited and its Commercial Chemicals Division

Now...a New advance in...

Gauge Safety!

Another step ahead in Marsh Gauges: the new Marsh "Safecase". Down to the final detail this gauge is developed for those applications where an unexpected surge of heavy, explosive over-pressure can occur.

In the "Safecase" a solid metal barrier protects the entire face. But, still more important, the *entire back* of the gauge is a thin, ductile plate, designed to open out when subjected to abnormal pressure. Back plate is held firmly to the case by two holding screws and cannot be dislodged by a pressure blowout.

In exhaustive tests it has never been possible to shatter the crystal or create any other dangerous condition in a "Safecase" gauge with its safety-release back. The accompanying illustration shows the result of one of a series of tests in which blank cartridges were fired in the back of the case without even breaking the crystal. Think what that means in safety to operating men!

Yes, an important development . . . but merely the kind you would expect from the manufacturer who originated the "Connoweld" tube, the "Marshalloy" case, the Mastergauge movement and practically all of the major advancements in pressure gauges. Ask for up-to-the-minute information.

Pressure of explosive force merely opens out safety back

Instead of depending on blow-out plugs, entire back of Safecase Gauge is designed to yield to over-pressure. Photo at left shows actual result of firing cartridge within back of case. Safety-release back exhausted pressure. Front remained intact.

MARSH INSTRUMENT CO.
Sales affiliate of Jas. P. Marsh Corp.
Dept. L, Skokie, Ill.
HOUSTON BRANCH PLANT:
1121 Rothwell St., Sect. 15, Houston, Texas
Marsh Instrument & Valve Co. (Canada) Ltd.,
8407 103rd St., Edmonton, Alberta, Canada

"THE STANDARD OF ACCURACY"

MARSH GAUGES

The coating system based on BAKELITE Vinyl Resins used on these offshore rigs was formulated by **Socony Paint Products Company**, Metuchen, N. J.

38 miles out...

could your coatings meet this test?

Thirty-eight miles out in the Gulf of Mexico, these drilling rigs stand protected against salt water spray, erosion and corrosion by a system of coatings based on BAKELITE Vinyl Resins.

Ten-foot seas are common. Drilling operations subject the structure to a deluge of water, residual oil, mud, sand, and shale —every day of the year. Salt and sun are always at work. Yet the coating—only 6 mils thick—eliminates the requirement for rigid repainting schedules. Other coating systems had been tried, but "not one worked as well."

Would your present coatings take such punishment? Compare them with a coating system based on BAKELITE Vinyl Resins. Test it on metal, masonry, or other materials, wherever resistance to moisture, corrosive atmospheres, acids, or alkalies is required. For names of suppliers and a free copy of our booklet "BAKELITE Resins Coatings for Industry," write today to Department TQ-128.

BAKELITE BRAND RESINS for COATINGS

Vinyl, Phenolic, Styrene and Epoxy Resins for Coatings

BAKELITE COMPANY, *A Division of Union Carbide and Carbon Corporation* 30 East 42nd Street, New York 17, N. Y.

The term BAKELITE and the Trefoil Symbol are registered trade-marks of UCC.

Frank Watts, left, veteran store manager for an independent distributor, having a branch at Bay City, Tex., and H. P. (Pat) McGuirt, tool pusher for Otis Russell Drilling Co., watch Pittsburgh Seamless casing being unloaded at a rig near Damon, Tex.

Santa Claus Must Wait When Oil Field Emergency Arises

It's shortly after midnight as Frank loads a swedge from his store for delivery to the Damon well.

Once he's at the well, Frank sits down in the bunk house with Mr. McGuirt to go over an order for delivery the next day.

Here's Why You Can Rely On Pittsburgh Steel's Independent Distributors

'Twas the Night Before Christmas in Bay City, Texas, as Frank Watts, his wife and their children retired for the night.

A few hours later—4 a.m., to be exact—Frank was awakened—not by Santa Claus and his reindeer, but by a telephone call from a driller 35 miles away.

Due to an unavoidable incident a small valve was needed immediately.

Because Frank Watts is a veteran supply man and manager of an independent supply company store (representing Pittsburgh Steel Company) in Bay City, he knew the importance of the driller's call. Holding up drilling costs money, whether it's Christmas morning or the 23rd of July.

Frank was on his way quickly, opened the store, got the valve, delivered it and made it back home in time to watch the kids open their gifts at 8 a.m.

This was not an unusual event as his wife recalls any number of times when Frank has shown up at dawn due to similar emergencies. For example, there was the night when he made a round trip to Houston (180 miles) for $12.00 worth of parts he was temporarily out of and which were badly needed on a rig.

At 36, Frank Watts is a tall, raw-boned, friendly man the movies would cast as a typical Texan. But more important, he's an oil field business man, a representative of one of the 18 independent distributors (listed at **right**) **handling Pittsburgh Seamless. And he has nearly 15 years of experience under his belt.**

He is accustomed to working 65 hours a week and it doesn't bother him to get frequent night calls, half of them to open his store so a driller can get an item he needs, the other times an SOS for delivery of supplies to keep a drilling operation going.

Frank Watts has "service" as his first and strongest business byword. Quality of the products he handles is a close second. As he puts it:

"I learned a long time ago that service and the best products available are the keys to profit and success in this supply business.

"If we handle only good quality stuff, proven material the men at

An oilman's assurance of quality—Pittsburgh Seamless—is the topic of this conversation Frank is holding at the well-site.

Frank watches cat-heading of Pittsburgh casing as it is run into hole. Frank's company handles a full range of Pittsburgh Drill Pipe, casing and tubing.

the rigs can rely on, and give them all the service they need, we'll get their business and we'll keep it."

Those words stand as testimony to the quality of Pittsburgh Steel Company's drill pipe, casing and tubing. The company Frank works for handles only Pittsburgh drill pipe, although it offers several manufacturers' casing and tubing.

They prove, too, why the independent supply house has become such a vital force in the oil and gas fields.

Independent distributors are ready for action around the clock. Frank's store stocks nearly 3,000 different items ready for delay-free normal operation or for emergencies.

An independent distributor's service is flexible. The independents are personal friends to the oil men they serve. Through their long experience, they know the problems oil men face and can meet their requirements without red tape and extra paper work. They are free from remote control and can make big decisions without wasting time. The independent store is usually the first in an oil field and the last to leave, if it ever does. Its personnel live in the area their stores serve. Their own personal futures are tied to the success they generate for themselves.

Independent distributors help keep costs low. Though they specialize in service, their prices are competitive. Their livelihood depends on meeting competition. Almost with no exception, the independent's representative will stay in the area of his store, not move on every couple of years. The money the independent makes stays where he makes it.

The independent offers only the best in equipment because he buys only what he wants to buy. He is free to select from the best equipment made. Pittsburgh Steel and all the other reputable manufacturers back up the independent distributor.

Independents are the most accessible suppliers in the oil fields. For example, Pittsburgh Steel's distributors have a total of 140 stores in all parts of the oil and gas fields.

Next time you buy drill pipe, casing or tubing use the team that can't be beat: Pittsburgh Seamless and your independent distributor.

Pittsburgh Steel Company

Grant Building • Pittsburgh 30, Pa.

District Sales Offices

Atlanta	Columbus	Detroit	New York	Tulsa
Chicago	Dallas	Houston	Philadelphia	Warren, Ohio
Cleveland	Dayton	Los Angeles	Pittsburgh	

Distributor Home Offices

Bradford Supply Company
130 Main Street
Bradford, Pennsylvania

Buckeye Supply Company
18 Harrison Street
Zanesville, Ohio

C. W. Cotton Supply Company
Utica National Bank Building
Tulsa 5, Oklahoma

Franklin Supply Company
624 South Michigan Avenue
Chicago 5, Illinois

Houston Oil Field Material Co.
1524 Maury Street
Houston, Texas

Industrial Supply Company
500 Eighth Street
Wichita Falls, Texas

Iverson Supply Company
400 West Fifth Street
Tulsa, Oklahoma

Lucey Export Corporation
233 Broadway
New York 7, New York

Lucey Products Corporation
624 South Cheyenne
Tulsa 19, Oklahoma

McJunkin Corporation
P. O. Box 513
Charleston 22, West Virginia

Midland Supply Company
Box 3105
Washington St. Station
Wichita 7, Kansas

Mountain Iron & Supply Co.
100 Rule Building
Wichita 2, Kansas

Murray Brooks, Incorporated
P. O. Box 855
Lake Charles, Louisiana

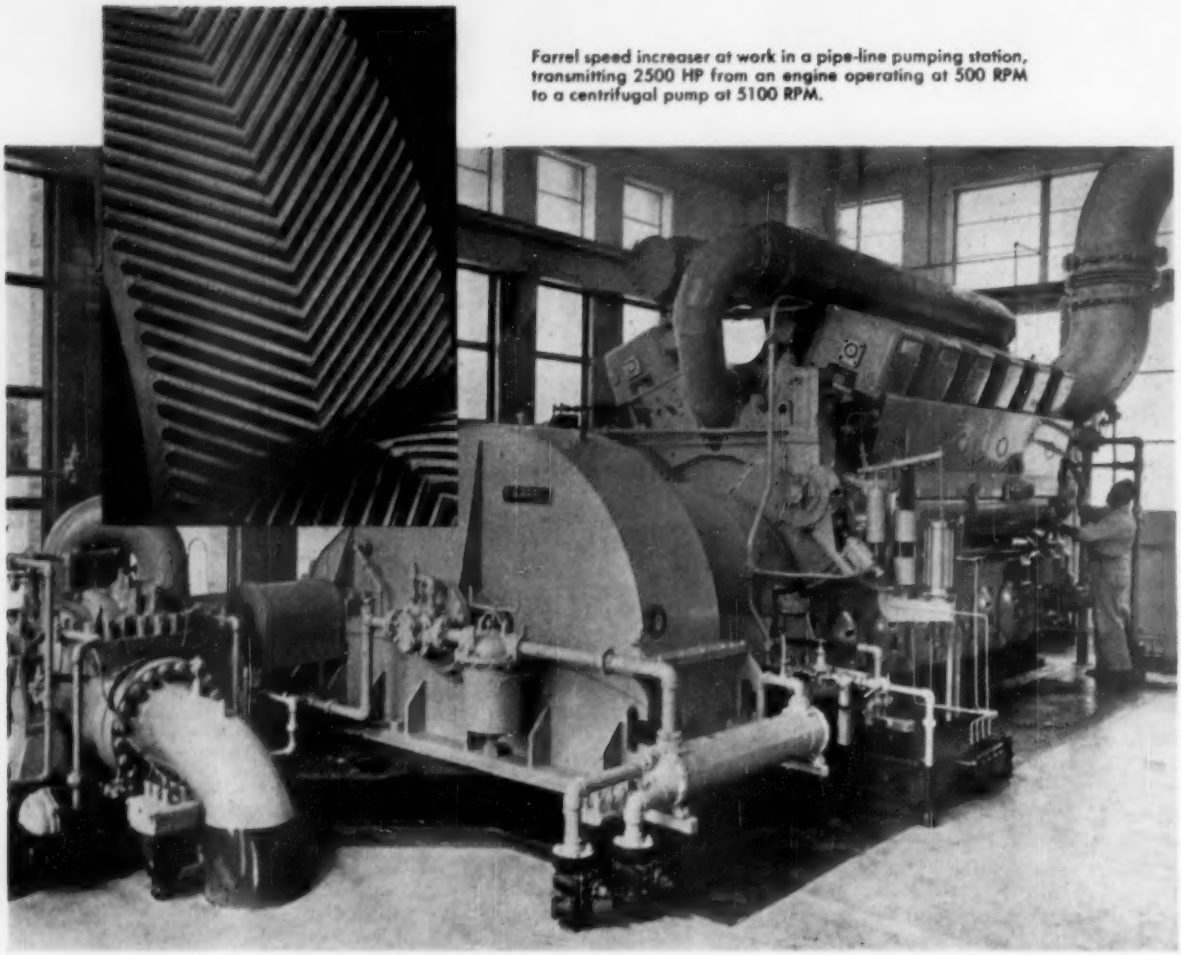
Producers Supply & Tool Co.
706 Commercial Standard Bldg.
Fort Worth 2, Texas

Rodman Supply Company
P. O. Box 2752
Odessa, Texas

Southwest Supply Company
1720 Oliver Building
Pittsburgh, Pennsylvania

Superior Iron Works & Supply Co.
P. O. Box 1800
Shreveport, Louisiana

Western Supply Company
424 North Boulder Avenue
Tulsa 1, Oklahoma



Farrel speed increaser at work in a pipe-line pumping station, transmitting 2500 HP from an engine operating at 500 RPM to a centrifugal pump at 5100 RPM.

HOW TO MAKE SURE

of service continuity in a speed increaser

Continuous, trouble-free operation is a first requirement in speed increasers for pipe-line service. This dependability has to be built into the unit. Every construction detail must be carefully engineered to provide ample reserves of strength and durability.

For example, the gears in a Farrel® speed increaser have a *backbone* formed where the helices meet. No center groove for tool clearance is required when double helical gear teeth are generated by the Farrel-Sykes method. The teeth are continuous and the full face width of the gear works at transmitting power. Result: Extra strength and load-carrying capacity in smaller space.

Oversize shafts guard against torsional deflection under peak torque variations. Shafts are mounted in husky, precision-finished bearings. Original alignment of moving parts is preserved by the rigid housing.

Proof of the dependability of Farrel speed increasers is on record. Since 1932, when they were first put into service, not a single unit has ever had to be replaced.

Remember this record when you are in the market for speed increasers. Send for details. Ask for a copy of bulletin 448-A.

FARREL-BIRMINGHAM COMPANY, INC.

ANSONIA, CONNECTICUT

Plants: Ansonia and Derby, Conn., Buffalo and Rochester, N. Y.

Sales Offices: Ansonia, Buffalo, Boston, Akron, Ann Arbor (Mich.), Chicago, Minneapolis, Fayetteville (N. C.), Los Angeles, Salt Lake City

OIL FIELD REPRESENTATIVES

Hercules-Lupfer Engine Sales Co., 124 N. Boston St., Tulsa 1, Okla.

V. W. Osborne, 860A M&M Bldg., Houston 2, Texas

Farrel-Birmingham ®

FB-1100

SCRUBOSPHERE* ...

... FOR *Cleaner Gas* AT *Less Cost!*

***PEERLESS SPHERICAL DUST and LIQUID SCRUBBER FOR GAS PIPELINES**

(A) The majority of incoming liquid and solid particles are directed down into reservoir. 1

(B) Lighter solid particles carried by gas stream are separated on surfaces of contactor which are kept wet and clean by revolving thru liquid reservoir. 2

(C) Contactor is revolved by explosion-proof gear motor.

(D) Mist Extractor removes any remaining liquid particles from gas stream prior to outlet. 3

- **The dust removal ability of the** SCRUBOSPHERE **is superior** because it utilizes wetted surfaces for dust collection which are much more closely spaced than in conventional equipment.
- **Oil loss is minimized** because the oil used to wet the dust collecting surface is lifted mechanically instead of bubbling gas through the oil which results in foaming and loss due to creation of hard-to-separate fine particles.
- **Maximum performance and low cost** — The spherical design means high capacity and performance because it provides maximum dimensions for the contactor and mist extractor which normally are limiting factors in scrubber designs. The vessel cost is reduced because required vessel thickness is only one half that required for cylindrical vessel of same diameter.
- **Versatility** — separates solid and liquid particles with equal efficiency.
- **Low pressure drop** — ½ to ¾ psi at rated capacity depending on nozzle size.

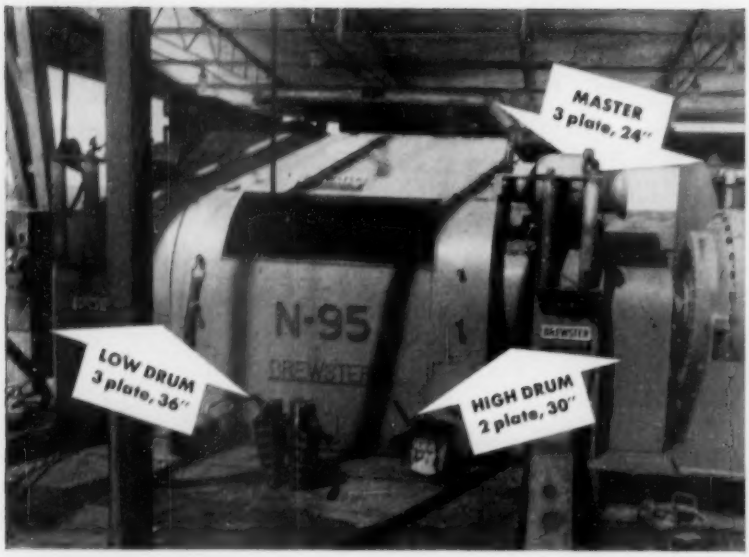
PEERLESS MFG. CO. DALLAS TEXAS

PEERLESS MANUFACTURING CO.

P. O. BOX 13165 DALLAS, TEXAS

Representatives in All Principal Cities

Write for test data showing dust removal and oil loss of Peerless Scrubosphere as against conventional dust scrubber.



Here's an over-all view of Marcum Drilling Company's rig working near Andrews, Tex., and a close-up of the Brewster N-95 Drawworks. The N-95 Drawworks uses Twin Disc PO Air Clutches as standard equipment for the master and rotary clutches as well as on the high and low-speed drums. Below: Twin Disc Model PO Air Clutch.

Off the bottom with 10,000′ of pipe on the high-drum clutch!

Working near Andrews, Tex., Marcum Drilling Company has a rig using a Brewster N-95 Drawworks *equipped throughout* with Twin Disc Model PO Air Clutches. "In one 28-day period alone," says Marcum's tool pusher, C. R. Rucker, "we made from 9 to 11 round trips daily fishing for 16 lost drill collars. The job was so tough we broke a 300-ton hook. Any clutch that can stand up to the punishment the rig took on that job just has to be good!"

Since this rig went into operation in mid-1955, it has drilled some 48,000 feet of hole. Mr. Rucker summed up the ruggedness of the Twin Disc PO Air Clutches in this way: "I doubt if we've ever pulled more than 100 stands of pipe with the low-speed clutch. All the work has been done with the high-speed drum and we've come off the bottom with 10,000 feet of 4½" pipe with that clutch!"

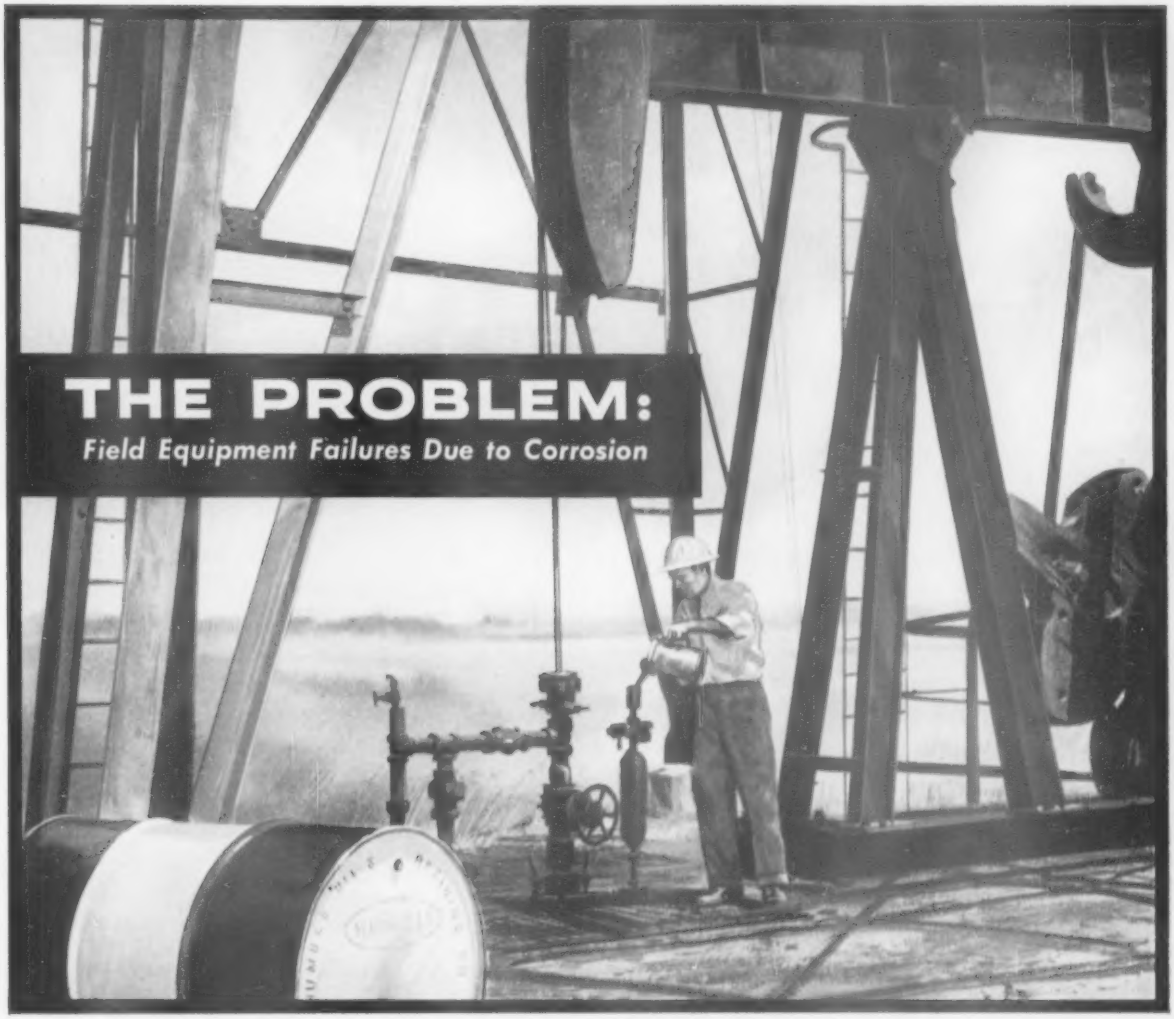
No, you don't baby the drawworks on a drill rig—not if you're after production. That's why so many manufacturers use Twin Disc Clutches as *standard equipment*. They know from experience — from operations like Marcum Drilling Company's — that Twin Disc Air Clutches are designed and built to take the most severe service the oil fields can give.

For complete details on Twin Disc Model PO Air Clutches and other power transmission products, write to your nearest Twin Disc District Office. Dallas: 1511 Turtle Creek Boulevard; RIverside 3014. Tulsa: Enterprise Building, Sixth and Boston; GIbson 7-1578. Los Angeles: 2950 Leonis Boulevard; LOgan 8-3309.

TWIN DISC
TWIN DISC
Clutches

TWIN DISC CLUTCH COMPANY, Racine, Wisconsin • HYDRAULIC DIVISION, Rockford, Illinois

BRANCHES OR SALES ENGINEERING OFFICES: CLEVELAND • DALLAS • DETROIT • LOS ANGELES • NEWARK • NEW ORLEANS • TULSA



THE SOLUTION: *Humble's* COREXIT—

a Proven Corrosion Preventive

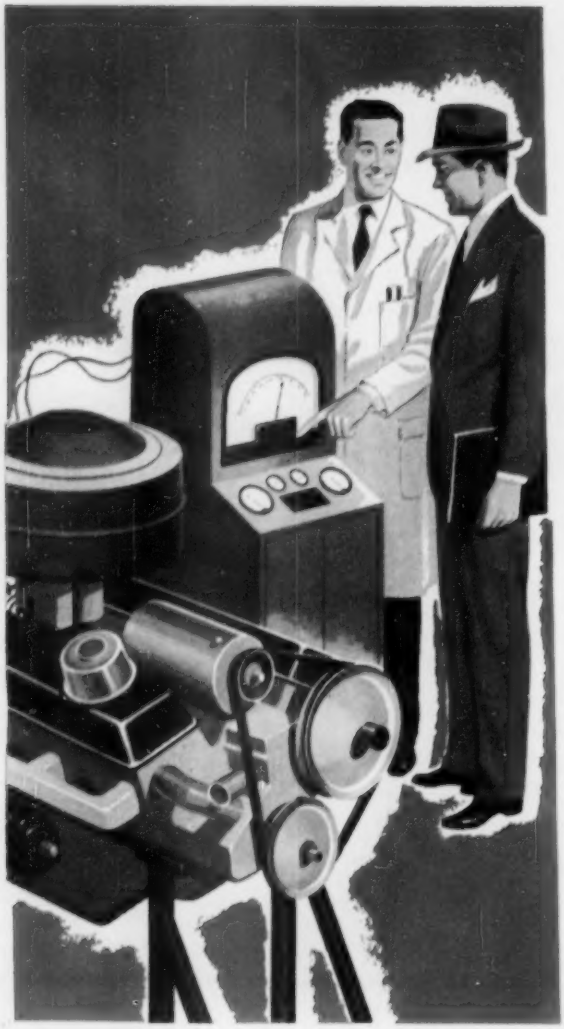
Corexit treatments give sucker rods and tubing positive protection against corrosion and hydrogen embrittlement, even in sour crude wells. *Corexit* cleans your sub-surface equipment, loosens scale and displaces moisture on the metal surfaces. Then it builds up a tenacious and lasting protective film on these clean metal surfaces to prevent further corrosion.

You will find lifting costs lower when you use *Corexit* because fewer well pulling jobs are necessary, and the life of your equipment is prolonged.

For complete information on *Corexit*, see your nearest Humble wholesale plant in Texas and New Mexico, or write or phone: Technical Service, Sales Department, Humble Oil & Refining Company, P. O. Box 2180, Houston 1, Texas.

HUMBLE

HUMBLE OIL & REFINING COMPANY



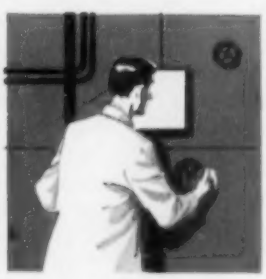
Our Lubrication Engineers worked with Engine Designers, then put

EXTRA anti-wear protection in AEROLUBE® 93-C!

Top anti-wear characteristics are specifically formulated into Cyanamid AEROLUBE 93-C inhibitor to give the extra protection required in engine break-in, severe service or other problem conditions faced by lubrication engineers. This concentrated zinc dithiophosphate inhibitor safeguards stability—it is an excellent oxidation inhibitor that prevents formation of harmful peroxides and organic acids. It sharply reduces wear of valve lifters and other critical engine parts.

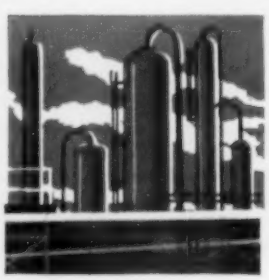
Zinc dithiophosphate has proved itself to be one of the most effective additives for commercial lube oils. Maximum wear resistance, oil stabilization and bearing protection, demanded by modern engines, have been built into Cyanamid's AEROLUBE 93-C.

Light color and compatibility with lube stocks and other additives, make AEROLUBE 93-C outstanding for use in premium oil products—for regular use as well as initial fill.



AERO® HDS CATALYST

In modern hydrodesulfurization processes, Cyanamid's new AERO HDS Catalyst contributes highest available volume activity and excellent mechanical properties. Cyanamid's specialized catalyst know-how may be helpful in initiating or improving your hydro-treating operation.



REFINING RESEARCH

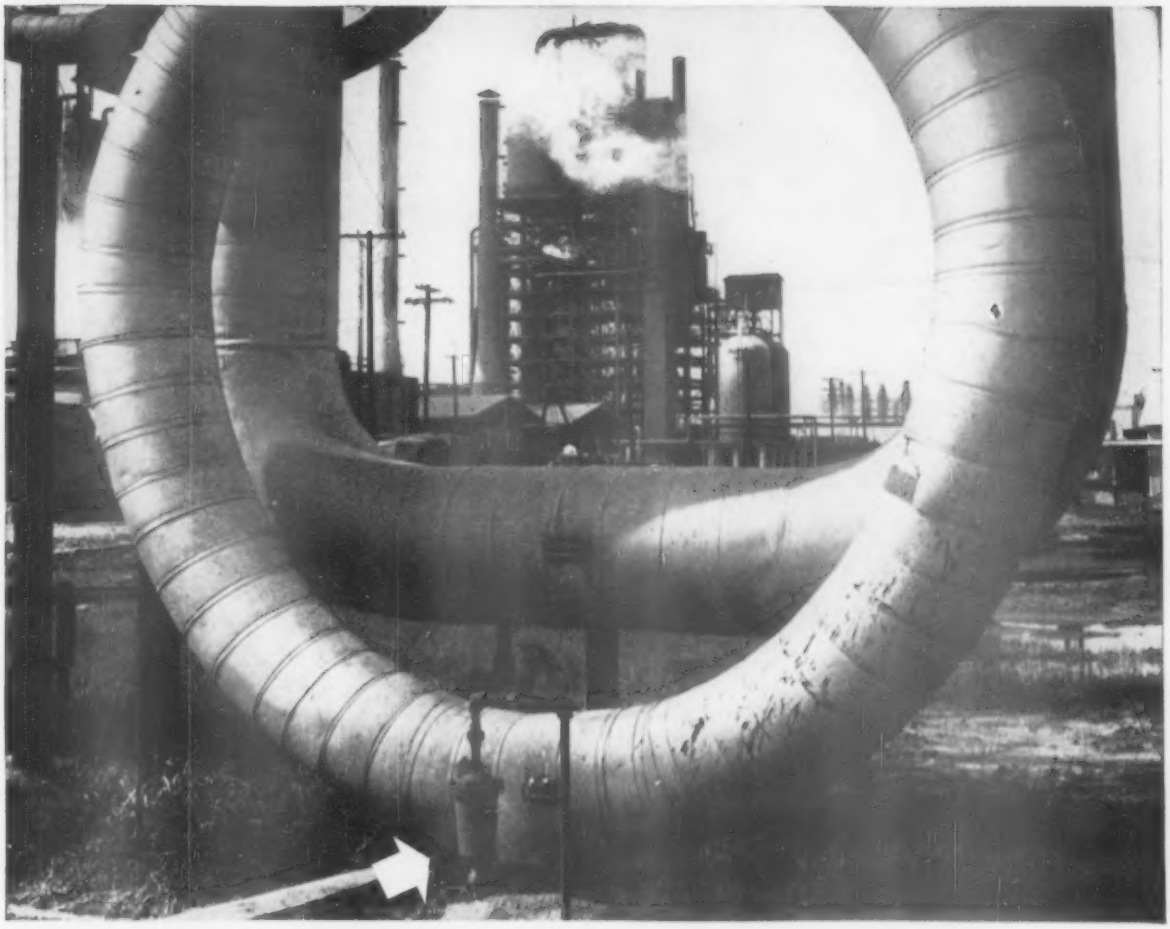
At Stamford, Connecticut, the Refinery Chemicals Department of Cyanamid maintains laboratories unsurpassed in the refining field for basic research and development in catalysts and other refinery chemicals. As a part of extensive research and pilot plant facilities, specialized equipment and methods—such as the electron microscope and vapor-phase chromatography—are used to develop information leading to improved products which give optimum performance under field conditions.

Our field men are constantly absorbing new developments at the research, development and operating levels. In this way, your Cyanamid man keeps abreast of the petroleum industry's dynamic technology and can offer a valuable technical service to refiners.

CYANAMID

AMERICAN CYANAMID COMPANY
REFINERY CHEMICALS DEPARTMENT
30 Rockefeller Plaza, New York 20, N. Y.

In Canada: North American Cyanamid Limited, Toronto and Montreal



Look Ahead When You Specify Steam Traps...

100 or 1,000 or 10,000 steam traps in a plant are a small item in relation to the processing equipment that depends upon them. But if they are troublesome, headaches are just multiplied by the number in use. It hardly pays, then, to be pennywise in specifying traps.

Perhaps the biggest single consideration in choice of traps should be their long-range performance. Look ahead—will the traps do the job? Will they stand up? Will they require frequent maintenance?

No traps in the world have ever turned in better performance records than Armstrongs. And, here is why:

Design—simple...only two moving parts . . . "frictionless" free-floating leverage . . . heavily reinforced for wear . . . generous safety margins.

Materials—file-hard chrome steel valve and seat, hardened, ground and lapped together. All other parts corrosion-resistant stainless.

Experience—designed and built by men with more inverted bucket trap experience than any other organization.

Inspection—quality control is not by sampling—*every trap* is tested before shipment.

Guarantee—satisfaction or your money back.

When you specify Armstrong traps you can look ahead to long, long trap life with infrequent maintenance. Ask your Armstrong Representative to give you details or write:

ARMSTRONG MACHINE WORKS
868 Maple Street, Three Rivers, Michigan

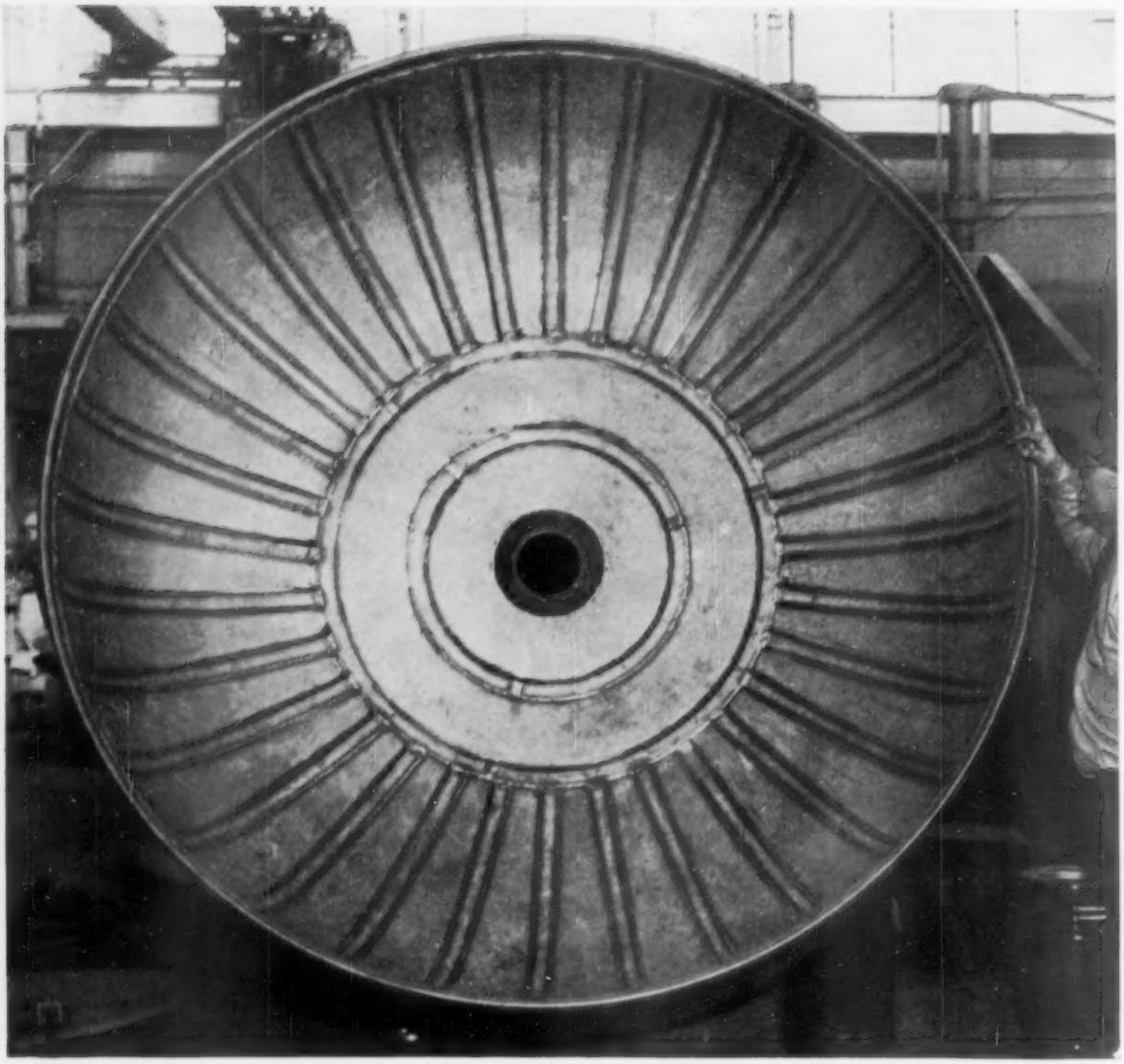
Application Engineered

ARMSTRONG STEAM TRAPS

ASK FOR STEAM TRAP BOOK

. . . 44 pages of practical data designed to give you better trapping. Free on request . . . no obligation.

575



FLYING SAUCER?

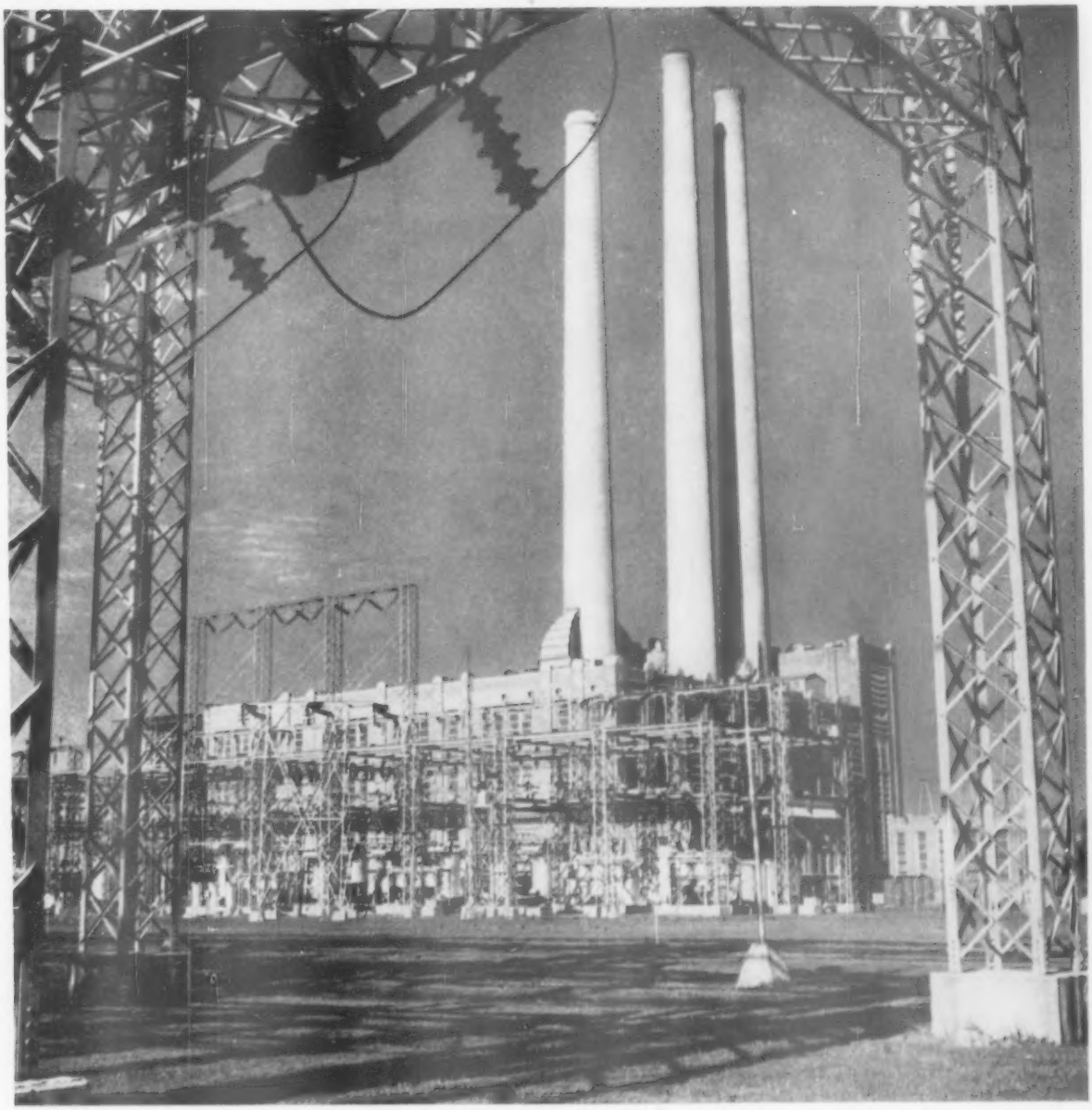
Could be . . . considering the craftmanship

This skillfully fabricated head is part of an absorber tower for the production of polyethylene. Of carbon steel with a carefully applied Hastelloy lining, it has proved very resistant to the highly corrosive reactions of gaseous chemicals under conditions of high temperature and pressure. For long-lasting equipment under exacting service conditions, Graver is a reliable source of skilled craftmanship.

GRAVER®

GRAVER TANK & MFG. CO., INC.

EAST CHICAGO, INDIANA • NEW YORK • PHILADELPHIA • EDGE MOOR, DELAWARE
PITTSBURGH • DETROIT • CHICAGO • TULSA • SANDS SPRINGS, OKLAHOMA
HOUSTON • LOS ANGELES • FONTANA, CALIFORNIA • SAN FRANCISCO

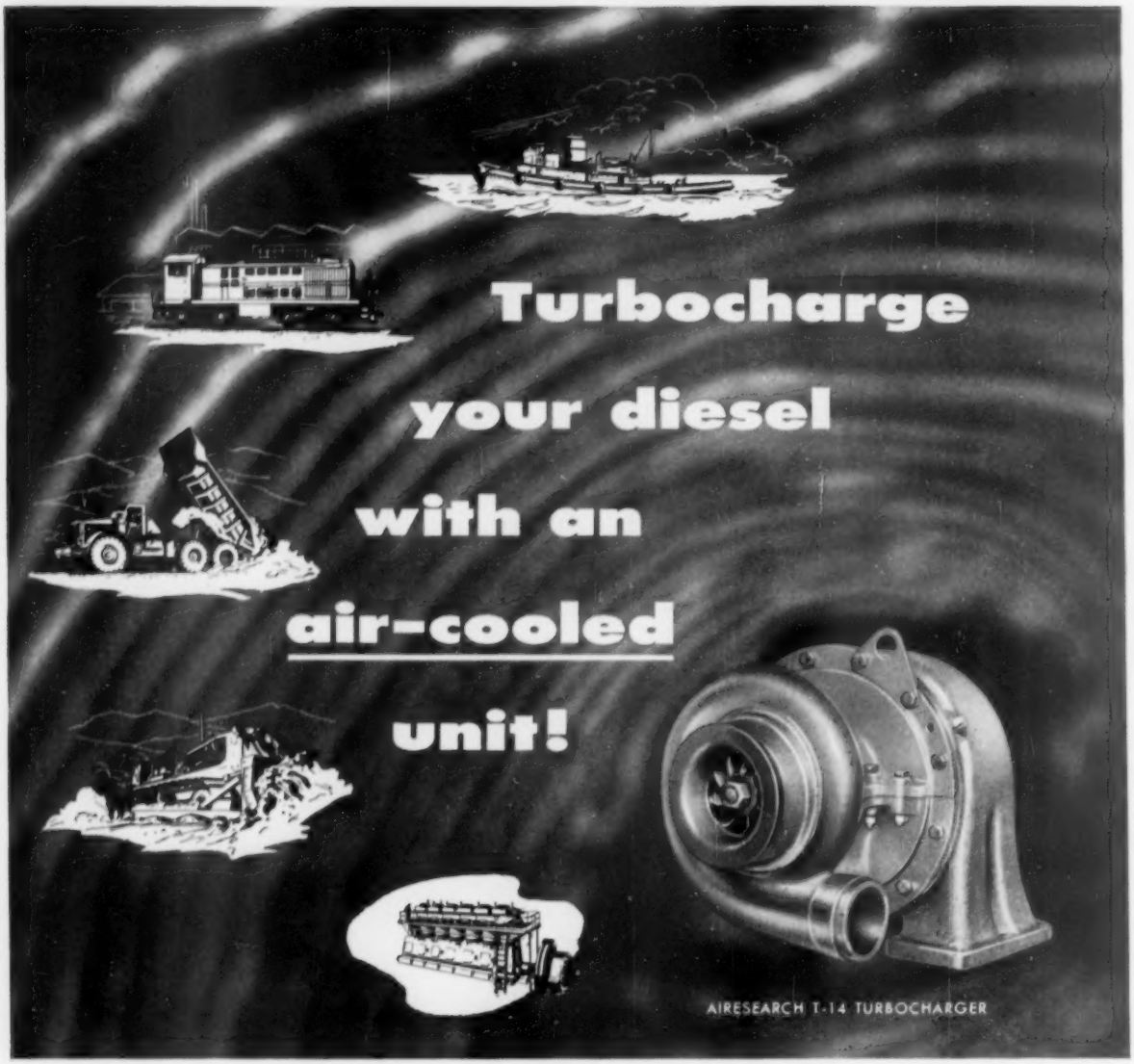


"Our forecasts indicate that even twenty years from now ... the atom will still account for only a small part of a greatly expanded amount of total energy consumed. In fact, we expect that in those countries where atomic power is developed, it will have the effect of increasing the consumption of oil products. Atomic power will provide the kind of energy adaptable to large-scale industrialization which, in turn, is the setting for an increased use of machines and equipment which depend for their power on oil. So we welcome the atom as a partner in the energy picture."

A statement by Eugene Holman, Chairman of the Board, Standard Oil Company (New Jersey)

ESSO

STANDARD OIL COMPANY (NEW JERSEY)
AND AFFILIATED COMPANIES



AiRESEARCH turbochargers increase power to the full capacity of the engine, yet require no extra plumbing and put no added burden on the cooling system.

The diesel industry generally has recognized the fuel-saving, noise and smoke reducing and power-adding advantages of turbocharging. But there are important differences between turbochargers. Some are difficult to service and add complicated plumbing because of the necessity for water-cooling.

All AiResearch turbochargers, from the smallest units for mobile equipment to the large, stationary power plant models, are air-cooled. Each contains a removable rotating assembly which simplifies maintenance, especially in the field. Their modern design resulted from the most extensive experience in the field of small turbomachinery in America.

We invite your inquiry on their application to your diesel equipment.

BASIC SPECIFICATIONS FOR AIRESEARCH TURBOCHARGERS					
MODEL	T-10	T-14	T-15	T-30-2	T-30-6
Diameter — in. nom.	9	11.5	15.25	15.25	16
Length — in.	9	14.12	16.75	17.25	21.75
Weight — lb.	40	95	125	135	195
Output — lb/min. (Standard Conditions)	25-40	35-65	35-65	70-95	115-175

THE GARRETT CORPORATION

AiResearch Industrial Division

9225 South Aviation Blvd., Los Angeles 45, California

DESIGNERS AND MANUFACTURERS OF TURBOCHARGERS AND SPECIALIZED INDUSTRIAL PRODUCTS

US RUBBER Pipe Protectors

...are put on a string in minutes!

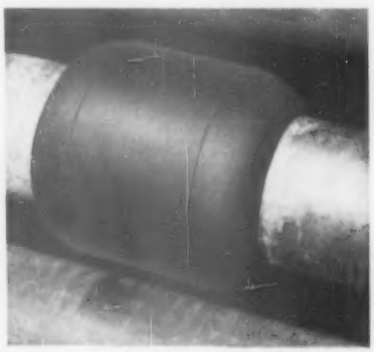
Operator is putting protector on the cone for expansion over the sleeve.

Hydraulic pressure forces the protector from the cone onto the sleeve.

Removing the sleeve now containing the expanded protector.

Slipping the sleeve and the protector over the pipe collar.

Protector is "kicked off" sleeve onto pipe. Note light delivery truck where second man is preparing another protector.



Sleeve quickly slips off and the protector fits tight to the drill pipe.

U. S. Pipe Protectors are the *best* protection for drill pipe and casing

- stop tool joint wear and prevent injury to casing
- lower vibration, reduce friction and torque
- simplify deep and crooked well drilling
- reduce twist-offs, "soft pipe" troubles and line "whip"
- unharmed by oils, acids, or high gas pressures
- can be used in any kind of mud
- can be successfully removed and re-applied... after use in oil-base muds
- anti-swirl end design prevents "pipe-ringing"
- solidly molded of a special neoprene compound
- made to fit every size drill pipe and casing condition

Ask for them through your supply house or authorized U. S. Rubber Pipe Protector Distributor. You'll get instant applicator service.

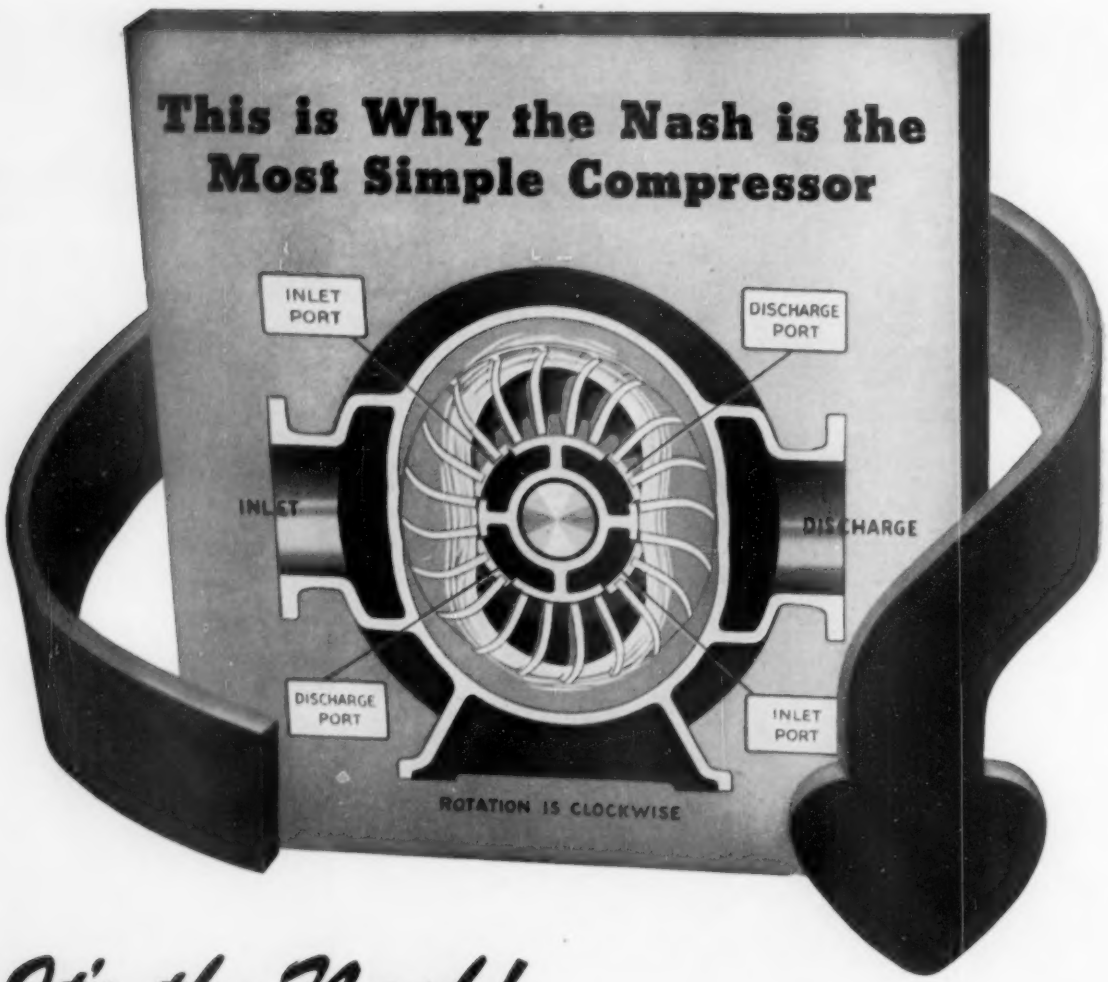
Coming Soon – New *Blue* Pipe Protectors for extra high pressures encountered below 18,000 feet.

Watch NCAA football, Saturday afternoons, NBC-TV

US RUBBER Mechanical Goods Division

United States Rubber

This is Why the Nash is the Most Simple Compressor



It's the Nash!

There are no mechanical complications in a Nash Compressor. A single moving element, a round rotor, with shrouded blades, forming a series of buckets, revolves freely in an elliptical casing containing any low viscosity liquid. This liquid, carried with the rotor, follows the elliptical contour of the casing.

The moving liquid therefore recedes from the rotor buckets at the wide part of the ellipse, permitting the buckets to fill with gas from the stationary Inlet Ports. As the casing narrows, the liquid is forced back into the rotor buckets, compressing the gas, and delivering it through the fixed Outlet Ports.

Nash Compressors produce 75 lbs pressure in a single stage, with capacities to 6 million cu. ft per day in a single structure. Since compression is secured by an entirely different principle, gas pumping problems difficult with ordinary pumps are often handled easily in a Nash.

Nash simplicity means low maintenance cost, with original pump performance constant over long periods Data on these pumps sent immediately on request

No internal wearing parts.

No valves, pistons, or vanes.

No internal lubrication.

Low maintenance cost.

Saves floor space.

Desired delivery temperature automatically maintained.

Slugs of liquid entering pump will do no harm.

75 pounds in a single stage.

NASH ENGINEERING COMPANY

313 WILSON, SO. NORWALK, CONN.

Pipeline construction. Moving out ahead of roads, to places other vehicles can't go, the "go-anywhere" performance-proved 4-Wheel-Drive 'Jeep' Truck carries men, tools and equipment along the right-of-way to speed the laying of pipelines.

'Jeep' vehicles GO where others can't to speed Oil and Gas operations!

Exploration. In good weather or bad, the Universal 'Jeep', with the extra traction of its 4-wheel drive, takes geologists, seismograph crews, tools and equipment to the most remote areas — wherever they need to go — regardless of rough or rocky terrain.

Transportation. Whether carrying engineers for inspection trips on the lease, or transporting supervisors and work crews, the 4-Wheel-Drive 'Jeep' Station Wagon is always on the move. Carries up to 110 cubic feet of equipment or six passengers.

Today, in nearly every phase of the oil and gas industry, whether transporting men and equipment cross-country, or operating a mobile drill for shot holes, 4-Wheel-Drive 'Jeep' vehicles are on the job, keeping work moving smoothly and on schedule.

These vehicles were designed for just such tough assignments as exploration for and transmission of oil and gas. No other vehicles can match their combination of stamina, versatility and the extra traction of 4-wheel drive. Time-tested and performance-proved, they've demonstrated their ruggedness in job-after-job. With the extra traction of "go-anywhere" 4-wheel drive they patrol along the pipeline or prospect — through mud, sand, soft earth or up steep inclines. They haul heavily loaded trailers over muddy lease roads, in good weather or bad. On the highway, they travel in conventional 2-wheel drive at top legal speeds.

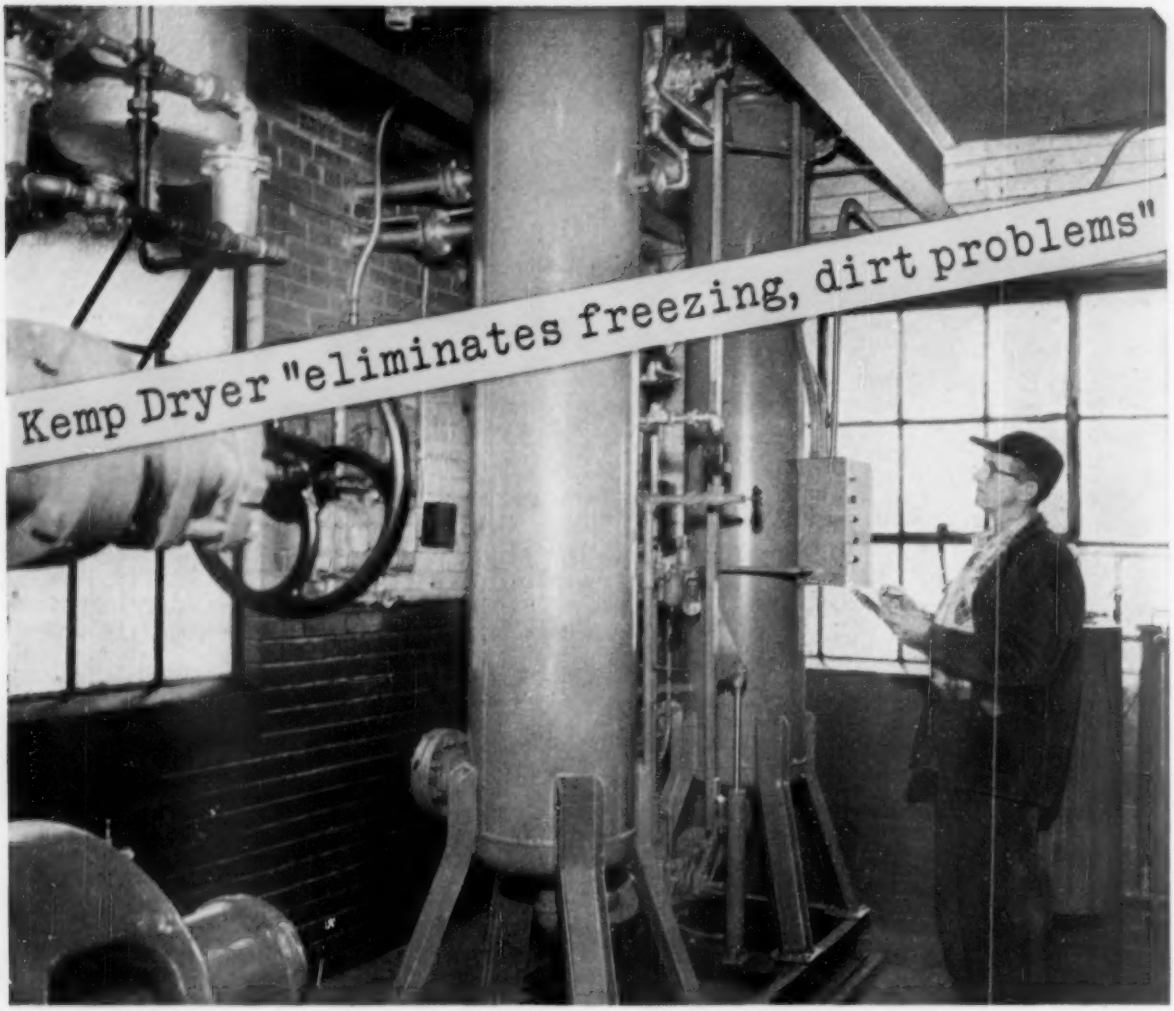
"Go-anywhere" 'Jeep' vehicles spread their costs over an almost endless number of jobs, give you additional savings through long life and low maintenance costs. Ask your Willys dealer for a practical, on-the-job demonstration, or write for information and detailed specifications to Dept. W, Willys Motors, Inc., Toledo 1, Ohio.

The 'Jeep'®

family of 4-Wheel-Drive Vehicles

WILLYS... makers of performance-proved utility vehicles

WILLYS MOTORS, INC., TOLEDO 1, OHIO



Quaker State Reports: *Kemp Dryer protects instrument lines from freezing at temperatures of 25° below zero*

Instrument failure is now a rare thing at the Quaker State Refining Corp., Farmers Valley, Pa. Quaker State installed a Kemp 300-E Oriad Dryer in December, 1954, and according to Process Supervisor Joe Brown it has really done a job safeguarding instrument operation.

Kemp Saves Time, Labor

The company no longer has to steam trace or insulate instrument air lines. A longer period of time can be allowed between servicing instruments. Even at temperatures of 25° below zero, none of the lines froze. And to further save time and manpower, the dryer is fully automatic! Between its "elimination of instrument failure and ease of operation," Kemp earned its place on the Quaker State team.

Kemp Dryers for Every Purpose

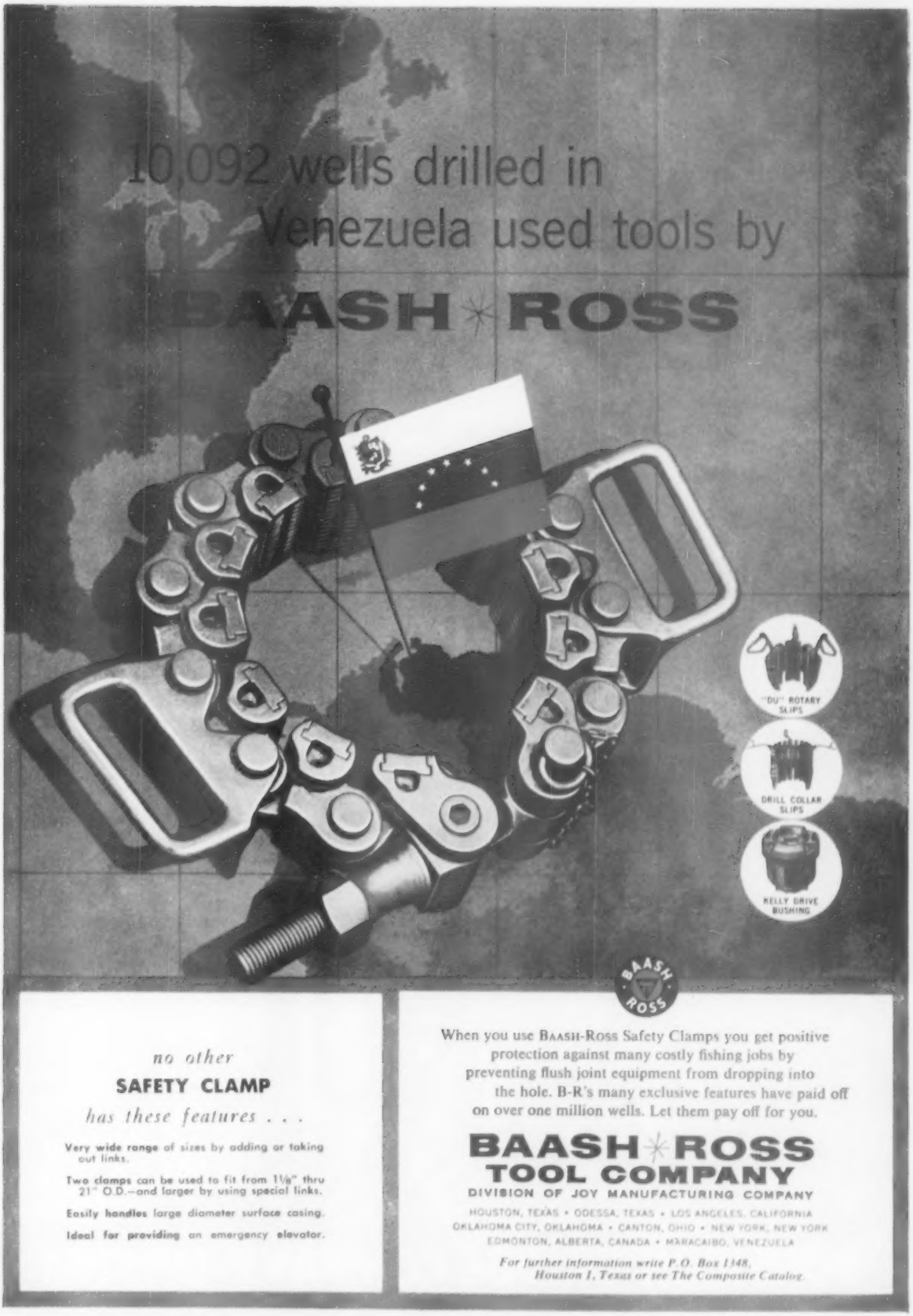
Kemp offers a variety of dryer models to meet all problems. Designed to dry air, gases or liquids to sub-zero dew points at low cost, they are constructed of quality materials and embody the engineering knowledge gained from Kemp's many years of experience. They are available with manual, semi-automatic, or fully automatic tower reactivation. In addition, Kemp will prescribe the proper desiccant for each specific drying job. If you have a problem involving the removal of water from air, gases, or liquids, contact Kemp engineers now. For complete facts and technical information, write for Bulletin D-27.

KEMP OF BALTIMORE

DYNAMIC DRYERS

CARBURETORS • BURNERS • FIRE CHECKS
METAL MELTING UNITS • INERT GAS GENERATORS
SINGEING EQUIPMENT

THE C. M. KEMP MFG. CO.
405 East Oliver Street, Baltimore 2, Maryland



no other

SAFETY CLAMP

has these features . . .

Very wide range of sizes by adding or taking out links.

Two clamps can be used to fit from 1⅛" thru 21" O.D.—and larger by using special links.

Easily handles large diameter surface casing.

Ideal for providing an emergency **elevator.**

When you use Baash-Ross Safety Clamps you get positive protection against many costly fishing jobs by preventing flush joint equipment from dropping into the hole. B-R's many exclusive features have paid off on over one million wells. Let them pay off for you.

BAASH * ROSS TOOL COMPANY

DIVISION OF JOY MANUFACTURING COMPANY

HOUSTON, TEXAS • ODESSA, TEXAS • LOS ANGELES, CALIFORNIA
OKLAHOMA CITY, OKLAHOMA • CANTON, OHIO • NEW YORK, NEW YORK
EDMONTON, ALBERTA, CANADA • MARACAIBO, VENEZUELA

For further information write P.O. Box 1148, Houston 1, Texas or see The Composite Catalog.

DOMINION BRIDGE
at Canadian Petrofina

Illustrated are two of many large pressure vessels fabricated by Dominion Bridge and now in service at Canadian Petrofina Limited—Canada's newest refinery.

Platework and structural steel by Dominion Bridge have been supplied to numerous Canadian refineries from coast to coast.

Send for copy of booklet "Platework for Every Industry" Publication No. PNN-100

DIVISIONS
- PLATEWORK
- STRUCTURAL
- MECHANICAL
- BOILER
- WAREHOUSE

Plants at:
MONTREAL
OTTAWA
TORONTO
WINNIPEG
CALGARY
VANCOUVER

Associate Company Plants at:
AMHERST
QUEBEC
SAULT STE. MARIE
EDMONTON

DOMINION BRIDGE COMPANY LIMITED

7 NEW, LIGHTER WEIGHT FILTERS

1261-E-69 1661-E-69 1961-E-69 1960-E 8-931-E 8-931-E1 16-931-E

The finest filters weren't good enough. So . . . Winslow made them even better!

Already the pioneer and basic patent holder for many of the most significant advances in fuel and lubricating oil filtration, Winslow once again demonstrates its leadership by introducing these seven new, lighter weight filters for automotive and industrial engines. Used singly or in multiples, at least one of these newly engineered filters will give *your* engine improved protection against the impurities found on lubricants, fuels, air, water and gases. More than ever, it pays to *insist on Winslow*. Here's why:

REDUCE EXCESSIVE HEAT IN LUBE OILS!

A properly installed Winslow Full-Flow Filter helps keep your lube oil cool in two ways: **First,** if installed externally or directly in the air stream from your fan, the filter provides air cooling for the oil. **Second,** the capacity of the filter, added to the capacity of your crankcase, means that with Winslow full-flow filtration you have a greater oil reservoir and therefore do a better job of ridding the engine of excessive oil heat.

GREATER GPM RANGE—Select the filter designed for your engine. With oil flowing freely through a filter of adequate capacity, your engine cannot suffer from lack of proper lubrication, nor will it overheat as readily.

CONTROLLED PRESSURE—You get more *positive protection* from Winslow Full-Flow Filters because of the patented "CP" Element, with its self-contained, dual capacity, Controlled Pressure flow.

LIGHTER WEIGHT—Profiting from experience gained in developing Winslow's famed aircraft engine filters, these new models are lighter in weight and thus easier to install.

ELEMENTS CHANGED EASILY—The specially designed clamp and "O" ring seal have made it possible to remove the filter lid more easily and change elements with less loss of time.

For complete information, write today to

WINSLOW ENGINEERING & MANUFACTURING CO.

4069 Hollis Street, Oakland 8, California

dbpc® antioxidant . . . a quality Koppers Chemical

Can these eleven advantages improve your gasoline and save you $1,000,000?

HOW ONE REFINERY SAVED $1,007,000

Inhibition of light cracked stock:	CASE 1 Phenylene-diamine	CASE 2 dbpc
Cost for treating 9000 B/D of 250-330°F intermediate fraction, $/day:		
Unisol treating, operating cost	—	1,130
Less to Unisol treating	—	nil
Acid treating and redistillation, operating cost	1,740	—
Less to acid sludge (3% at $4.50/bbl.)	810	—
Doctor treating, operating cost	530	—
Less to Doctor treating (3% at $4.50/bbl.)	810	—
Total	3,690	1,130

Saved with dbpc on production of 45,000 bbl./day: dollars/day 2,760

45,000 bbl./day: dollars/year 1,007,000

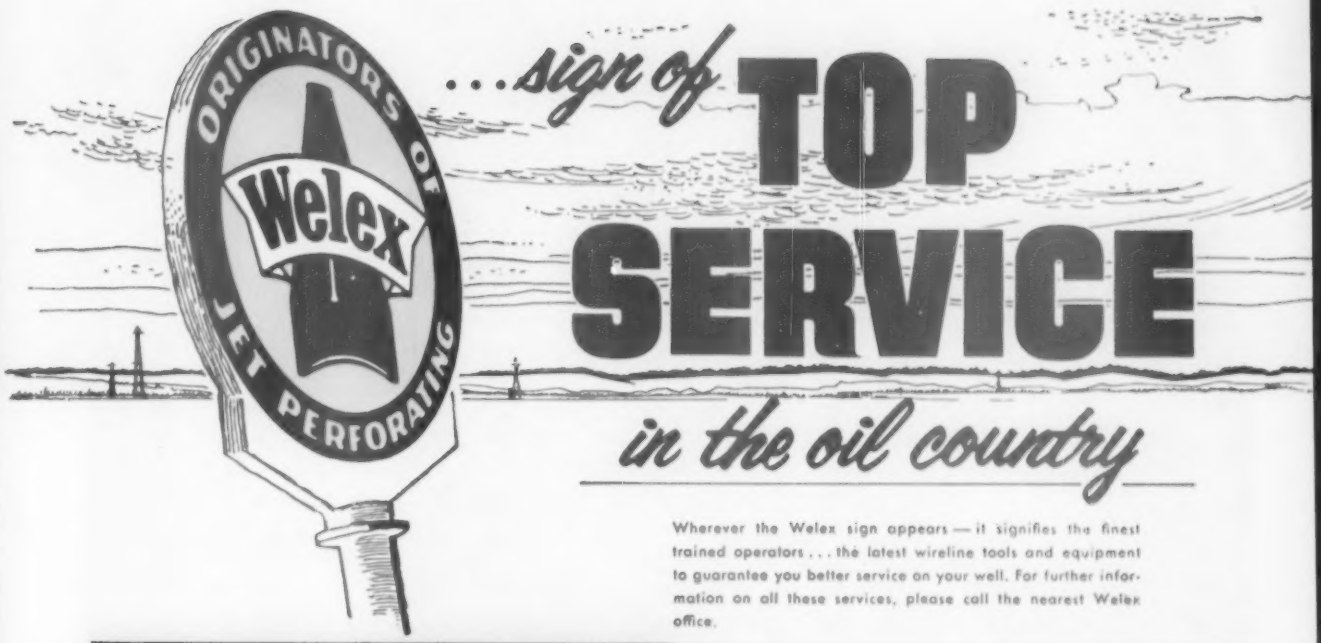
The cost of inhibition was practically identical for the two cases cited above. Let our representative give you specific money-saving details relating to your operations. Koppers Company, Inc., Chemical Division, Department OGJ-116, Pittsburgh 19, Pennsylvania.

1. **dbpc** (di-tertiary - butyl - para - cresol) gives the best protection against gum formation in gasoline, when compared under conditions of use with today's leading antioxidants.
2. **dbpc** reduces treating costs.
3. **dbpc** keeps automotive power systems clean because it keeps unstable gasoline constituents from depositing in carburetors, manifold piping, and intake ports.
4. **dbpc** doesn't induce "tank sweetening."
5. **dbpc** is a more effective oxidation inhibitor because it can be added early in the refining process and is not extracted by sweetening, caustic washing, clay treating, or water washing.
6. **dbpc** is not extracted by aqueous corrosion inhibitors, nor by acidic water solutions sometimes found in tank bottoms and pipelines.
7. **dbpc,** being inert, does not cause gasoline to darken or change color.
8. **dbpc** does not require special handling precautions.
9. **dbpc** retains more of its antioxidant properties than other types, in the presence of iron, copper, brass, and other copper-bearing metal alloys.
10. **dbpc** provides excellent stabilization of aviation gasolines and tetraethyllead fluids.
11. **dbpc** is safer and easier to handle than other antioxidants, because it is relatively non-toxic and non-irritating.

KOPPERS

KOPPERS CHEMICALS

SALES OFFICES: NEW YORK · BOSTON · PHILADELPHIA · ATLANTA
HOUSTON · CHICAGO · DETROIT · SAN FRANCISCO · LOS ANGELES



...sign of TOP SERVICE in the oil country

Wherever the Welex sign appears — it signifies the finest trained operators . . . the latest wireline tools and equipment to guarantee you better service on your well. For further information on all these services, please call the nearest Welex office.

1 ***Jet Casing Perforating***
A jet for every completion need.

2 ***Simultaneous Radioactivity Logging***
New magnetic collar locator for greater accuracy.

3 ***Open Hole Perforating***
Powerful Welex Torpedo Jets for maximum performance.

4 ***Down Hole Junk Shots***
For fast cleanup of fishing jobs.

5 ***Thru-Tubing Perforating***
Welex "Swing" Jets for the best permanent-type completions.

6 ***Formation Fracturing Tool***
Shattering power for pre-fracturing jobs.

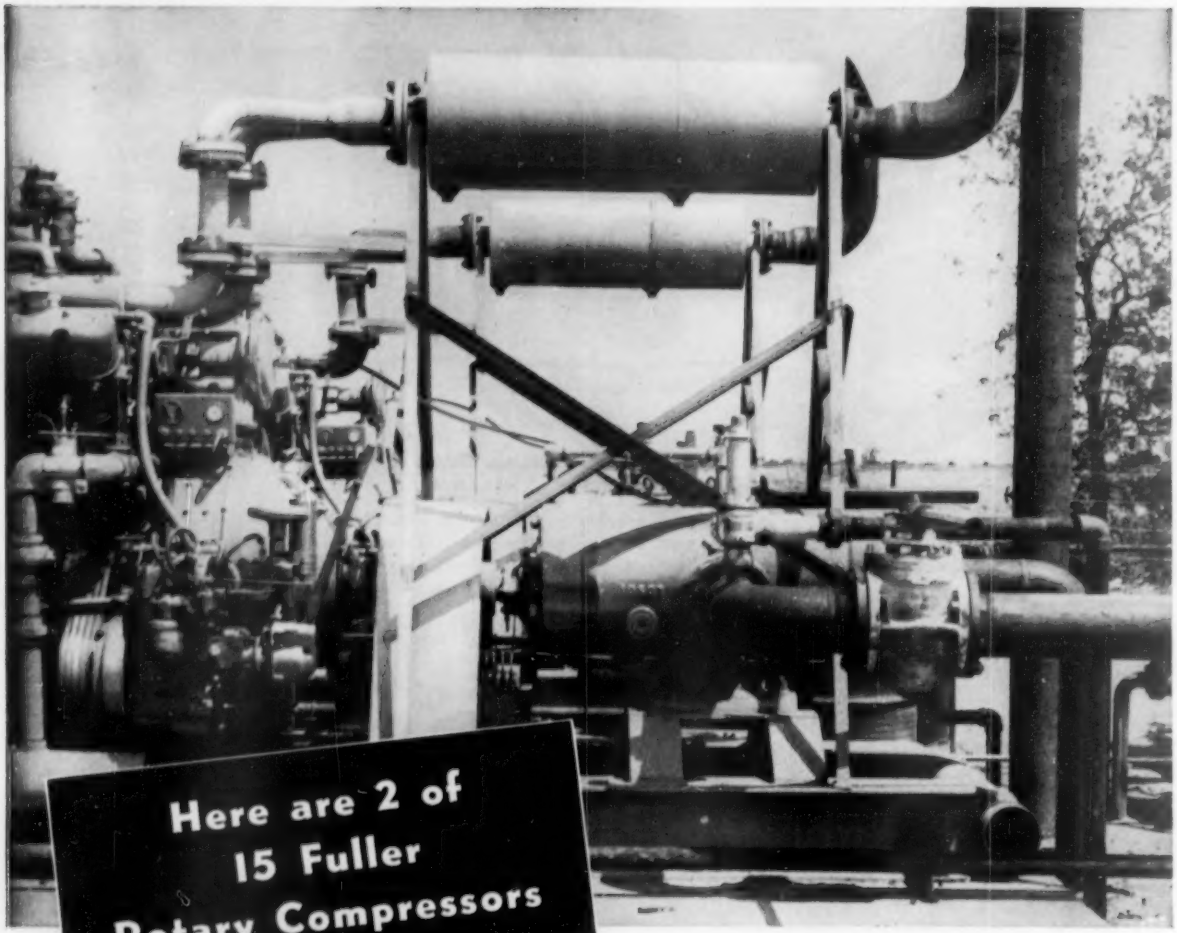
7 ***Wireline Squeeze Cementing***
"Spot" Cementing—just where you want it.

8 ***Other Associated Wireline Services***

Call WELEX and BE SURE!

Welex
JET SERVICES, INC.

General Offices: 1400 E. Berry St., Fort Worth, Texas • **Sales Offices:** Dallas, Wichita • **Division Offices:** Houston, Midland, Tulsa, Oklahoma City, Denver • **District Offices:** Abilene, Ardmore, Beaumont, Corpus Christi, Falfurrias, Farmington, Fort Morgan, Great Bend, Hobbs, Houma, Houston, Kimball, Lafayette, Lake Charles, Liberal, Odessa, Pampa, Pauls Valley, Pawhuska, Plainville, San Angelo, Shawnee, Sherman, Snyder, Stillwater, Wichita Falls, Winfield.



Two of the 15 gasoline engine-driven Fuller Rotary Boosters, rated at 1,465,000 standard cubic feet per day at 800 r.p.m.

at "most unusual gasoline plant to go on stream in recent years"

This description of a gasoline plant in northern Texas appears in a recent article in the technical trade press.

One of the unique features is its plant gathering system, comprising between 125 and 150 miles of 2" through 14" pipe.

The plant is served by 15 Fuller Rotary compressors, each with a capacity of 1,500,000 cu. ft. per 24 hrs. Each compressor is a completely independent, skid-mounted unit, taking suction at 0 to 5 psig and discharging gas into the transmission system at 45 psig.

"Most unusual", too, is Fuller performance. Fuller's simple rotary design with a minimum of moving parts makes for smooth, *sure* operation around the clock and unattended. Hundreds of Fuller installations at out-of-the-way well heads attest to the fact that these compressors do the job—and do it *by themselves*.

Whether you're in the market for one or 15 or more compressors, the cold, money-saving facts prove that for workaday dependability, the *lasting* choice is Fuller. We have plenty of information on design characteristics and typical Fuller applications which we'll be happy to send to you.

FULLER COMPANY, 132 Bridge Street Catasauqua, Pa.
GENERAL AMERICAN TRANSPORTATION CORPORATION SUBSIDIARY
Chicago • San Francisco • Los Angeles • Seattle • Birmingham

Fuller
. . . . pioneers in harnessing AIR

C-269
1488

SPECIALIZED PETROLEUM PROCESSING

for producers and refiners

PETRECO ELECTRIC DEHYDRATION

Petreco electric dehydration is an automatically controlled method for reducing the B.S. and W. content of crude oil to pipe line specifications. It is particularly adaptable for large central plant dehydrating systems and also is highly effective on low gravity crudes.

PETRECO SEDIMENT SEPARATION

Where producers utilize sub-surface hydraulic production pumps, it is essential that the power oil be clean, dry and free from fines, sediment, etc. Petreco Electric Sediment Separation removes such impurities from crude oil and delivers clean power oil.

PETRECO ELECTRIC DESALTING

Petreco pioneered electric desalting and is the recognized leader in this field. Petreco offers a choice of desalting vessels, to better handle varying volumes of crude. In every refinery where Petreco desalters have been installed, salt difficulties have been stopped.

PETRECO ELECTROFINING

Electrofining is a Petreco development and offers a revolutionary method for caustic washing, acid contacting, doctor treating and nitrogen base removal. Electrofining usually is a single-unit, one-pass, automatically controlled, continuous process.

PETRECO — BENDER SWEETENING

The Petreco Bender Process is utilized for sweetening gasoline, kerosine, jet fuel and No. 2 fuel. Sweetening is effected by converting mercaptans to disulphide by oxidation. The chemical cost is low, throughput rates are high, and catalyst can be rejuvenated at the plant.

PETRECO ELECTRIC LUBE-OIL TREATING

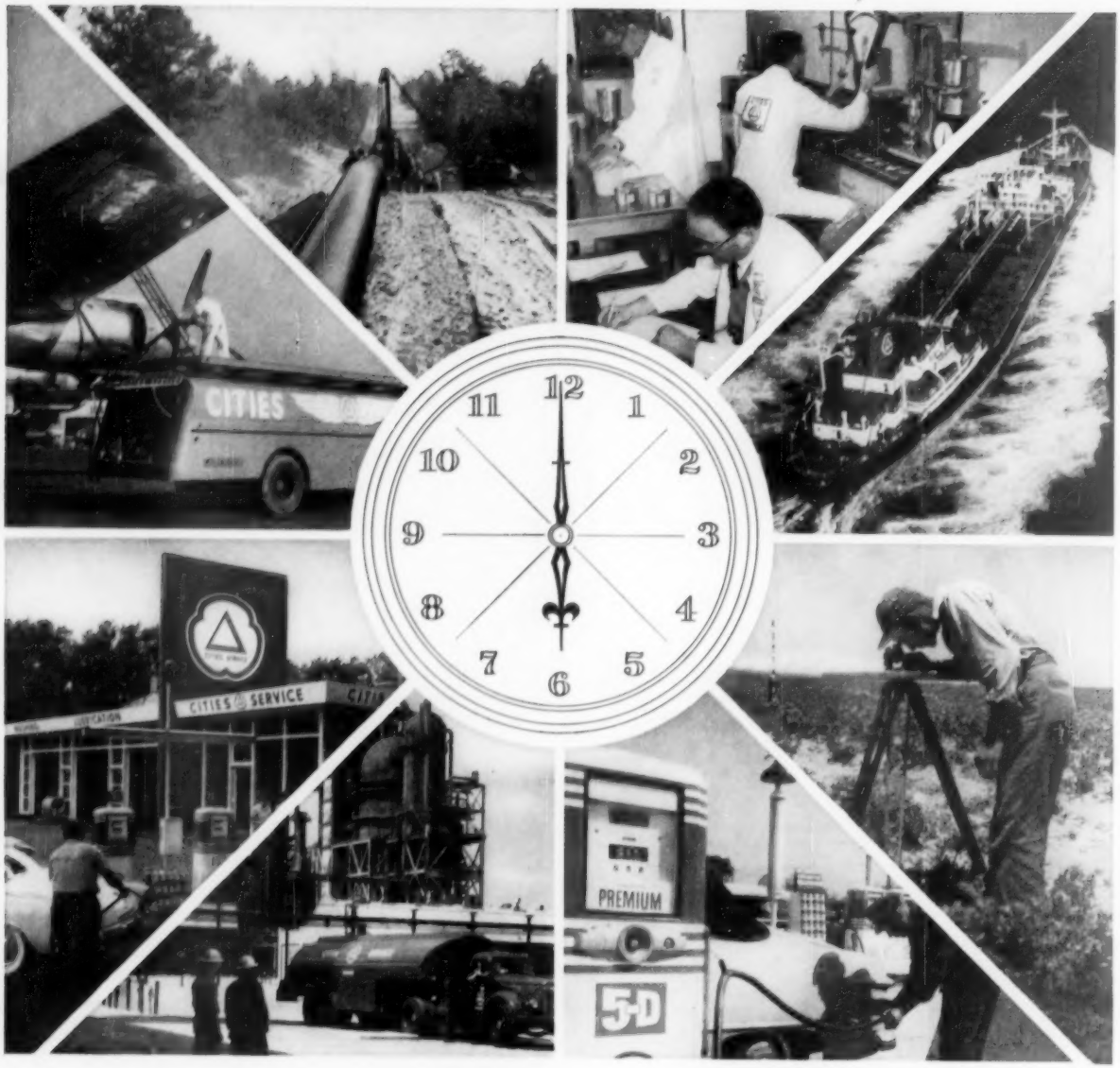
Petreco Lube Oil Treating provides continuous, automatically controlled acid treatment for lube oils and similar stocks. Treating takes place in a closed system, requiring much less tankage than conventional acid treaters. It saves acid, time, space and guesswork.

PETRECO®

A DIVISION OF PETROLITE CORPORATION

3202 South Wayside Drive, Houston 1, Texas • **1390 East Burnett Street, Long Beach 6, California**

AP4-8



A DAY

in the lives of a quarter of a million people

More than 240,000 people keep Cities Service, one of the world's largest oil companies, operating at full steam . . . 240,000 people who locate, produce, refine, improve, market and invest in the petroleum that constitutes any oil company's lifeblood.

A winning team? Judge for yourself: Today, Cities Service is pushing forward in ever longer strides, with new refining facilities and techniques, new oil discoveries, new pipelines and tankers, new dealers, and new and improved petroleum products, unsurpassed in quality.

Moreover, the very fact that this surging activity exists, serves to assure further expansion . . . for healthy growth stimulates still more growth.

And significantly, this growth is more than the sign of a healthy company . . . it's living proof of a healthy country. For it again demonstrates the rich harvest of a system in which government, industry, and all citizens share an interest and an obligation toward each other.

CITIES SERVICE

Progress through Service

What you need here is an ALDRICH PUMP

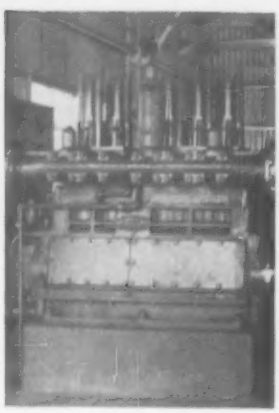
Where pumping operations demand *complete reliability*, Aldrich Pumps assure it—along with unusual freedom from maintenance.

Dependable service. Continuous, heavy duty pumping—at high pressures—is routine with Aldrich Pumps. Aldrich gives dependable low-cost performance in waterflooding, pipe line, gasoline plant, hydrocarbon, injection and petrochemical services. The simplicity of the Aldrich Direct Flow design and the reduced space between valves result in higher volumetric efficiency.

Low-cost maintenance. Fluid end sectionalization, with changeable plunger sizes and interchangeability of parts, means long life and fast, easy maintenance. Parts can be replaced easily and quickly, at low cost. Valves can be removed for inspection or replacement without special tools or equipment. Individual sections of the fluid end can be replaced at a fraction of the cost of conventional type fluid ends.

Get full details. Write for your copy of Data Sheet 100, a condensed catalog and selection table covering our entire line. The Aldrich Pump Company, 9 Gordon Street, Allentown, Pa.

Field parts stock available in Cermi, Ill., Charleston, W. Va., Houston, Los Angeles, Odessa, and Tulsa.



Two Aldrich 3½" x 5" Direct Flow Pumps on lean oil service. Aldrich Direct Flow units are available in 2½", 3", 5" and 6" stroke sizes with 3, 5, 7 or 9 plungers. Sizes range from 25 to 2400 hp.

THE ALDRICH PUMP COMPANY

A Smoother Roll Out with Eastman CASING ROLLERS

The most rugged, efficient, effective, and economical tool devised for rolling out casing and liners to their original gauge.

Eastman Casing Rollers are constructed of heat treated steel. Multiple rollers create a smooth rolling action that opens the casing without splitting.

For many years Eastman Casing Rollers have been available in API sizes ranging from 3½" to 17⅝" —

. . . AND NOW . . . A NEW 22" CASING ROLLER IS AVAILABLE FOR ROLLING OUT CONDUCTOR CASING.

For service — call the Eastman office nearest you.

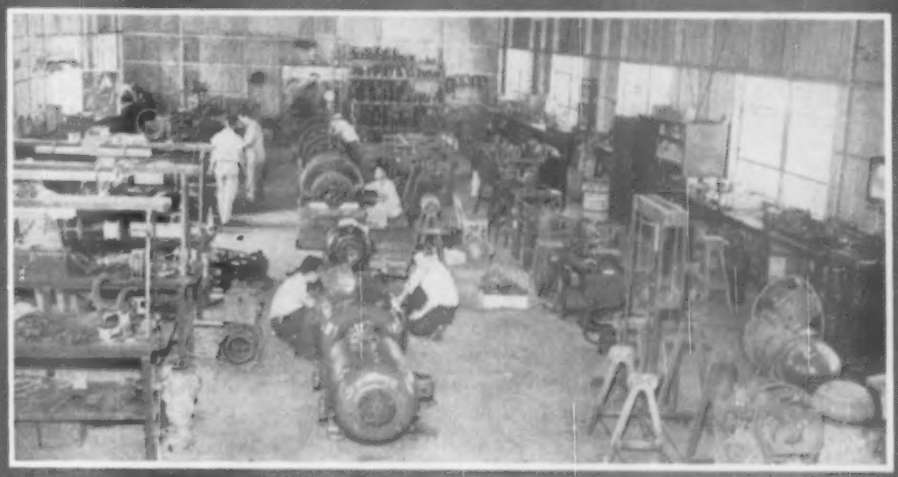
DIRECTIONAL DRILLING
Eastman
OIL WELL SURVEYS

EASTMAN OIL WELL SURVEY COMPANY

LONG BEACH • DENVER • HOUSTON

Export Sales and Service:
EASTMAN INTERNATIONAL COMPANY
P. O. Box 1500 • Denver, Colorado, U. S. A.

Avondale ...



prompt & efficient electrical service for the Oil & Marine Industries

Among the many and varied services of Avondale, one of the most outstanding is our Electrical Department at the Harvey Plant. Here you will find complete facilities to meet your needs on any and all types of electrical work. Our men are skilled in the most modern intricacies of electrical equipment, and specialize in motor rewinding as well as other types of electrical repair. As in other phases of our operation, we have specialized and diversified to meet the requirements of the industries we serve—you will find us well versed in the electrical needs of your industry.

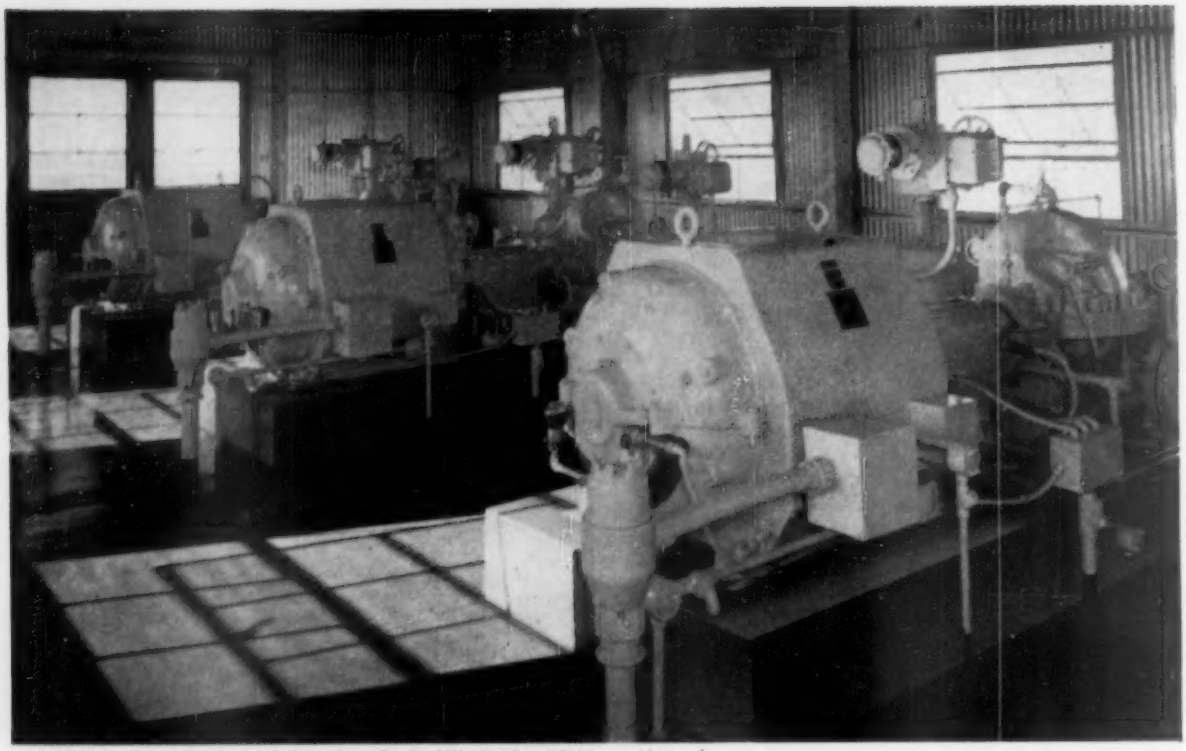
The next time you need electrical work done . . . call Avondale.

SERVICE • INTEGRITY • EFFICIENCY

SHIP BUILDING • SHIP REPAIRING • FOUNDERS • PROPELLERS • STRUCTURAL STEEL

AVONDALE MARINE WAYS, INC. CABLE ADDRESS "AVONWAYS"

P. O. BOX 1030 • PHONE UNiversity 6-4561 • NEW ORLEANS 8, U. S. A.



DOWN IN CRESSON, TEXAS, three Louis Allis 500-hp, 3600-rpm, 2300-volt open motors drive centrifugal pumps at main-line station of a major oil company.

STATIONS STAY ON-STREAM

with Louis Allis Motors built to pipeline requirements

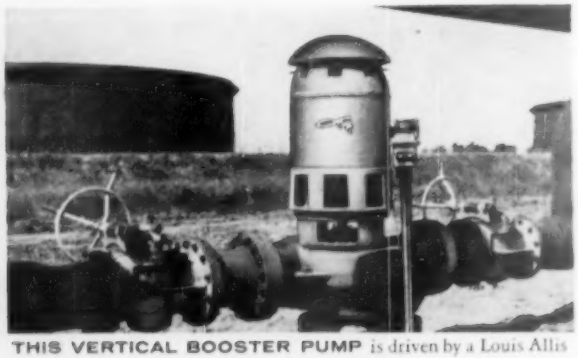
There is a Louis Allis Motor designed specifically for your pipeline job—one with long-life features that protect against costly downtime and maintenance.

Where a Louis Allis standard motor doesn't fill the bill exactly, you can get prompt delivery on a unit specially designed to give you the electrical and mechanical characteristics best suited to your needs.

Contact your nearby Louis Allis Field Engineer—or write us—for a solution to your motor problem, based upon our more than 50 years' experience.

THE LOUIS ALLIS CO.
MILWAUKEE 7, WISCONSIN

TRANSFER TERMINAL IN CORPUS CHRISTI is equipped with three Louis Allis 200-hp, 3600-rpm, 440-volt motors.



THIS VERTICAL BOOSTER PUMP is driven by a Louis Allis 350-hp, 3600-rpm explosion-proof motor.

Split hairs? We split "spider webs" to give you better alloy steels

SHEFFIELD

ARMCO

High Strength
•
Shef-Ten
•
Forging Quality
•
Aircraft Quality

ALLOY STEELS

Accuracy is measured right down to the millionth part in the making of Sheffield Alloy Steel.

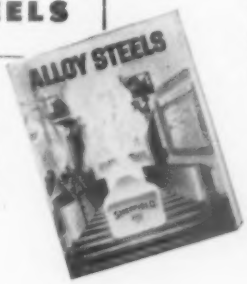
Here a technician measures with a densitometer the exact quantity of each element in a furnace sample. This unit provides a double check on other production control equipment which electronically analyzes each heat. Each alloying element, no matter how minute the quantity, must make the right contribution to obtain the physical and mechanical properties required for each particular end use.

Sheffield Alloy Steels in drill bits and collars penetrate the rock strata of the earth. In aircraft and guided missiles, they pierce the stratosphere.

As a manufacturer of just about any product using alloy steels, you'll find the metal tailored to your needs in Sheffield High Strength, Shef-Ten, Forging and Aircraft Grades. Get in touch with us.

Get your copy of "ALLOY STEELS"

If you're a manufacturer or otherwise engaged in industries served by alloy steels, write for your free copy of the Sheffield ALLOY STEELS book.



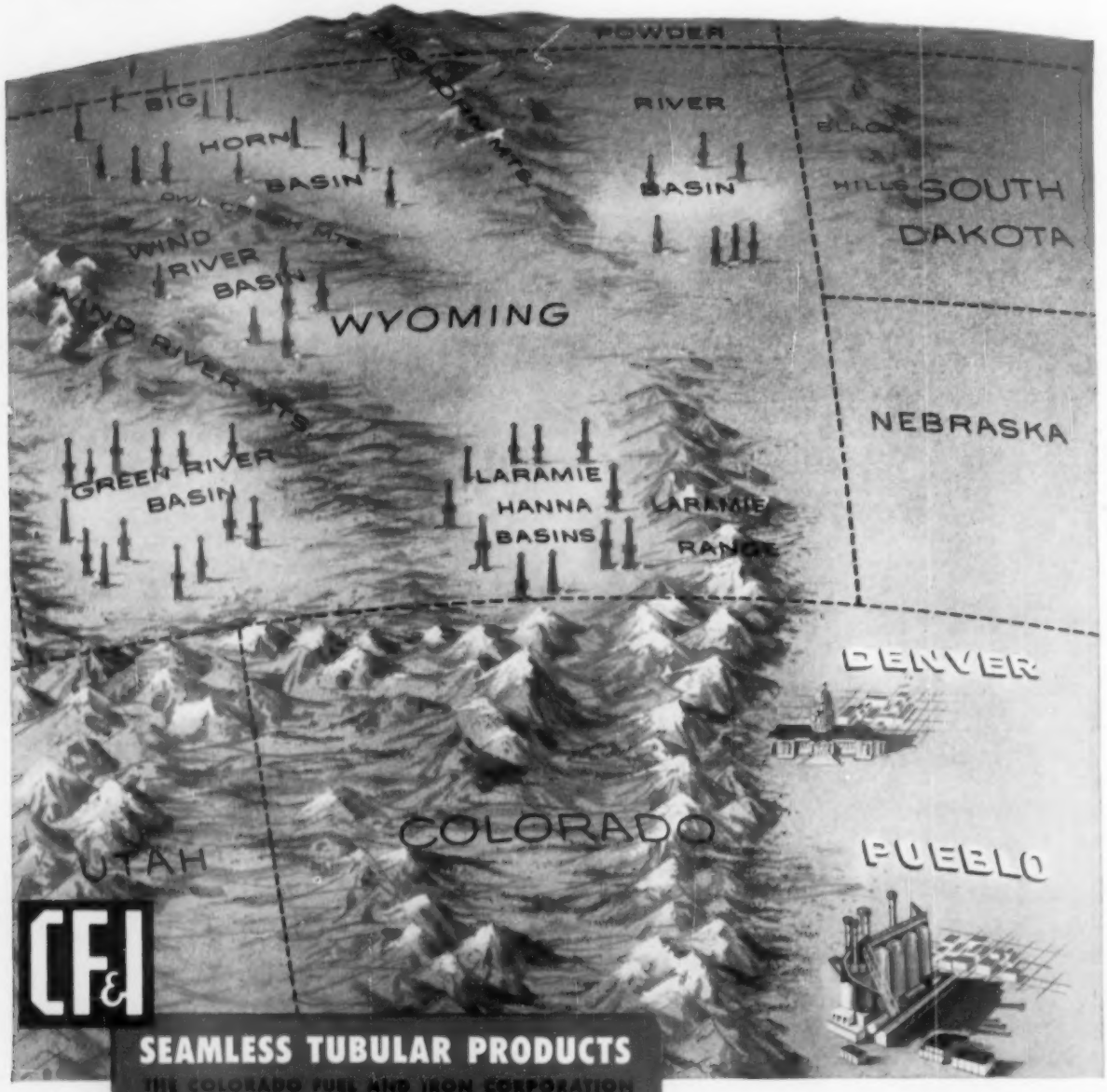
SHEFFIELD STEEL
DIVISION
ARMCO STEEL CORPORATION
SHEFFIELD PLANTS: HOUSTON • KANSAS CITY • TULSA

you'll find
CF&I SEAMLESS CASING AND TUBING
throughout the Wyoming basins

Today, CF&I Seamless Oil Country Casing and Tubing is serving operators throughout Wyoming's Big Horn, Green River, Laramie-Hanna, Powder River and Wind River Basins—just as it is serving other oil field operators all over the West.

Why such popularity? The answer is *quality*—quality that assures each operator that CF&I's conveniently located Seamless Tube Mill offers them casing and tubing manufactured for maximum service.

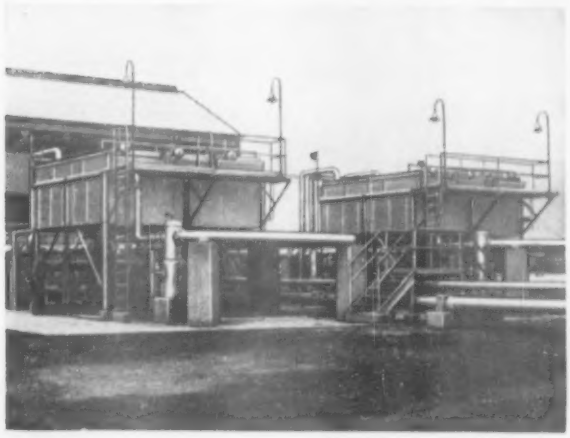
It will pay you to specify *CF&I* Seamless Oil Country Casing and Tubing. Available in 2⅜" through 9⅝" O.D., this dependable product meets or exceeds API STD 5A specification. See your CF&I representative today for complete details.



4478

Young Engineering Talent

Shows Results in Actual Use at Illinois Gas Storage Field



Young "H-C" UNITS . . .

cool natural gas for underground storage

Hundreds of feet below Herscher, Illinois, lies a geological dome used to store natural gas for Chicago and 24 other gas utility companies in a six-state area. Before gas from the pipelines can be injected into the underground reservoir, it is cooled by two Young "H-C" units to eliminate the danger of cracking or warping the well cementing and disturbing the underground formation. Young "H-C" horizontal core units combine the *efficiency* of vertical air discharge, the *economy* of compact design, and the *versatility* of multiple unit combinations.

More Young "H-C" Units used in desulphurization of vent gas

Also in operation at Herscher is a vent gas gathering system which gathers, desulphurs and re-injects into the reservoir escaping gas. Here, too, Young "H-C" Units cool the gas to the proper degree before it is re-injected.

Write Dept. 206-L for FREE CATALOG

Put Young Talent to work for you . . .

Solving heat transfer problems is what we do best because it is our very reason for being. You, too, can harness the power of Young engineering talent. Write, wire or call without obligation.

HC is a registered trademark.

Young RADIATOR COMPANY

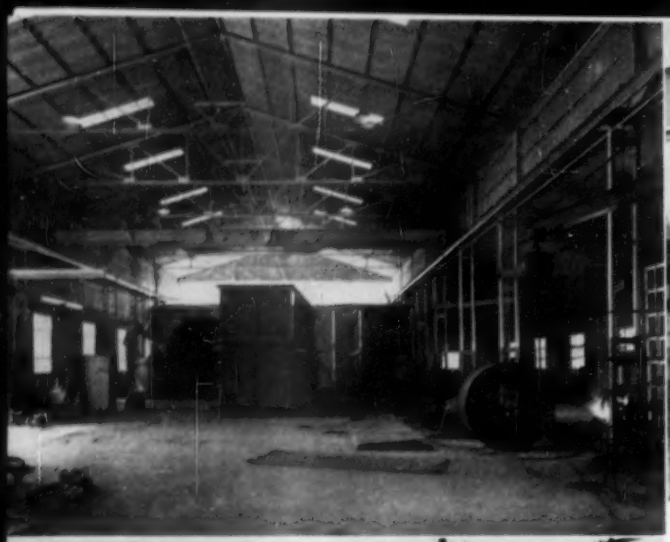
RACINE, WISCONSIN

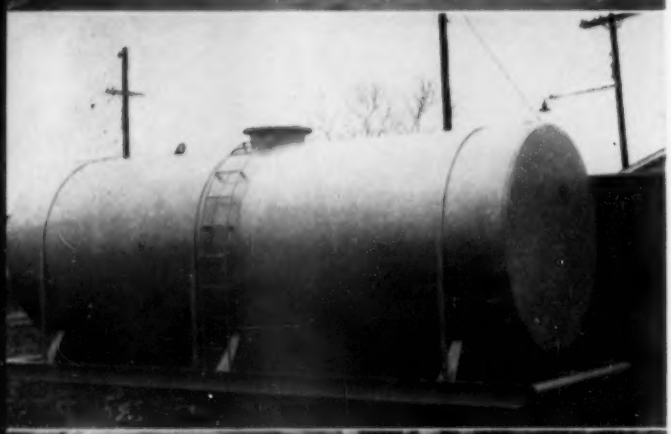
Creative HEAT TRANSFER ENGINEERS FOR INDUSTRY

Heat Transfer Products for Automotive, Aviation and Industrial Applications. Heating, Cooling, Air Conditioning Products for Home and Industry.

Executive Office: Racine, Wisconsin, Plants at Racine, Wisconsin, Mattoon, Illinois

UNCONDITIONAL GUARANTEE
If this Housing ever Breaks or Distorts we will replace it Free.
THE RIDGE TOOL CO.
ELYRIA, O.
RIGID HEAVY DUTY 14
14
there's Only one



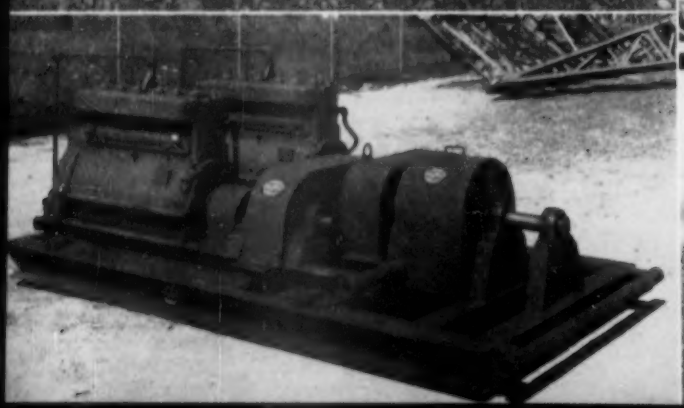


These are standard rig specialties of Joe Stine, Inc., known throughout the industry for dependability, quality and economy. We invite your inquiries.

ENGINEERS · DESIGNERS · FABRICATORS · MACHINISTS

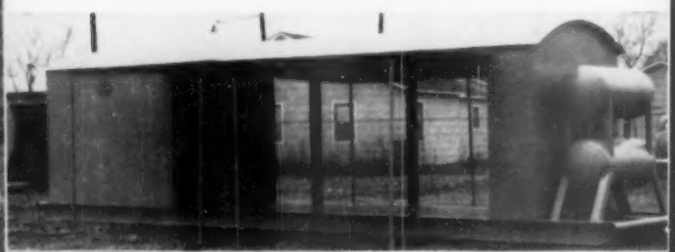
JOE STINE, INC.

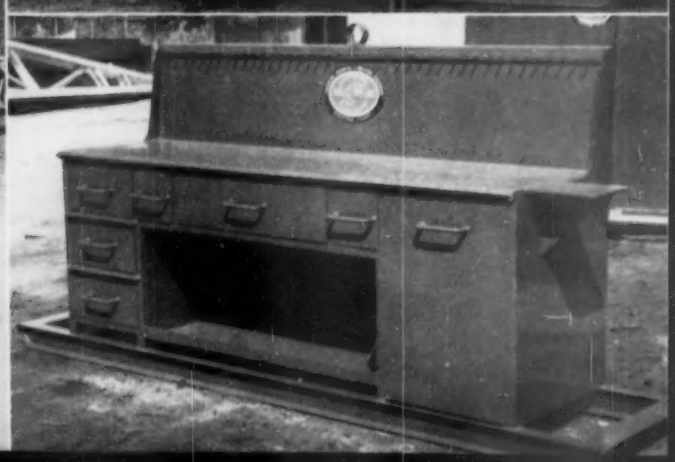
HOUSTON, TEXAS



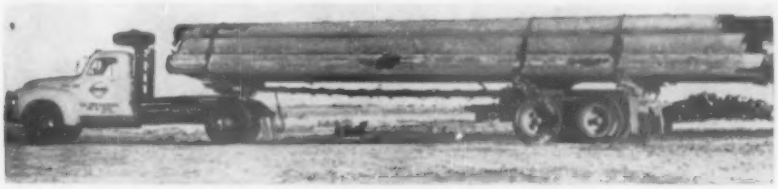
JOE STINE, INC.

BOX 14471 • HOUSTON 21, TEXAS • JA 8-0591





EQUIPMENT MEN . . . in the News



Spencer-Safford Celebrates 40th Anniversary

Celebrating its fortieth anniversary this year, Spencer-Safford Loadcraft, Inc., can look back on the day in 1916 when an oil-field trucker in Augusta, Kans., complained to Fred Spencer, who was then a blacksmith, that equipment for hauling pipe was inadequate.

Spencer developed a tag-along trailer, now known as a pole trailer, to help truckers in the El Dorado field. The pole trailer was quickly adopted by truckers throughout the oil fields and Spencer organized the trailer company that now manufactures a broad line of standard and custom trailers.

A far cry from the original tag-along trailer, the pole trailer above is one of 18 Spencer-Safford units recently purchased by a pipeline stringer to use on the Trans-Canada pipeline project.

Guiberson Elected to Dresser Board of Directors

G. G. GUIBERSON

The election of Gordon G. Guiberson to the board of directors has been announced by H. N. Mallon, chairman of the board of Dresser Industries, Inc., Dallas, Tex. The new board member is the president of Guiberson Corp., Dallas, a leading manufacturer of oil tools and molded-rubber products for oil-well drilling and production. Since 1951, Guiberson has headed the firm which was founded in 1919 by his father, S. A. Guiberson, Jr., and two brothers.

The assets of Guiberson Corp. were acquired by Dresser Industries in August 1956.

Porter's W-S Fittings Division Appoints Rainey

William Rainey has been appointed manager of new-product development for W-S Fittings Division, H. K. Porter Co., Inc., according to Jackson Kemper, vice president and general manager.

Rainey will be in charge of market research and new-product development for the division and will assist in correlating the efforts of the sales and engineering departments. While his office will be at the plant in Roselle, N. J., Rainey will travel in the field, contacting division salesmen, distributors and customers.

Prior to his present appointment, Rainey was self employed. He had also been associated with Orr & Sembower Co. and American Chain & Cable Co.

Greenwell Is Midwest Manager for Girdler

The appointment of Bartley A. Greenwell as Midwest district manager with headquarters at the Board of Trade Building, Chicago, has been announced by John E. Slaughter, Jr., vice president in charge of The Girdler Co.'s Votator division.

Before becoming associated with the Votator division as a sales engineer in 1954, Greenwell was the president and general manager of his own company, Oxygen Service Co., Inc., Kingsport, Tenn.

The Votator division is an engineering and manufacturing organization. It designs, engineers, and installs complete plants for the processing of many industrial products. Girdler Co., Louisville, Ky., is a division of National Cylinder Gas Co., Chicago.

HTL Holds Formal Opening of New Instrument Plant

Three well-known leaders of the oil industry formally opened the new Houston Technical Laboratories building recently. Eugene McDermott, chairman of the board of Texas Instruments, Inc., and Dr. J. C. Karcher, now president of Concho Petroleum Co., co-founders of the seismic method of oil-field exploration, were assisted by Cecil Green, chairman of the board of Geophysical Service, Inc., in activating an HTL blaster to light a smoke fuse that cut a ribbon across the building entrance.

The HTL building houses the research and manufacturing facilities. Forty thousand square feet of floor space have been arranged within the building for use in the expansion of the company. Included in the basic design are provisions for compatible additions of space more than equal in size to the present building.

Houston Technical Laboratories was organized in 1946 by Sam Worden for the construction and distribution of the quartz element Worden gravity meter. The meter combines the features of light weight and integral compensation for temperature variation without special heating or cooling units.

In 1953 Texas Instruments, Inc., a publicly owned company located in Dallas, bought HTL from Worden and

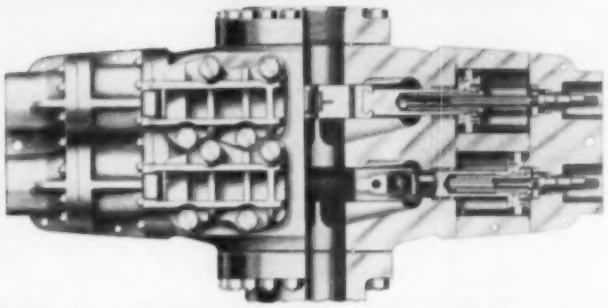
The traditional ribbon-cutting ceremony was given the geophysical-electronic treatment at the formal opening of Houston Technical Laboratories' new main plant. Shown operating the HTL ribbon cutter are Dr. J. C. Karcher, president of Concho Petroleum Co.; Cecil Green, chairman of the board of Geophysical Service, Inc.; and Eugene McDermott, chairman of the board of Texas Instruments, Inc.

THROUGHOUT THE OIL WORLD

leading operators place their confidence in Shaffer pressure control equipment because it embodies three basic advantages: (1) it is quality equipment, built throughout to the highest standards of safety, long life and low maintenance. (2) it embodies unique engineering advancements that assure easier, more-positive operation and quicker, simpler servicing. (3) it is available in a choice of sizes and types to meet virtually every field condition and pressure requirement!

For Pressure Control at its BEST...

SHAFFER!



SHAFFER HYDRAULIC CELLAR CONTROL GATES

• Available in both *Double* (illustrated above) and *Single* types. Both available in choice of *Non-Rising* Locking Shafts (for those preferring maximum compactness) and *Rising* Locking Shafts (for those preferring quick indication of ram position).

• Space-saving compactness . . . Double (with *two* ram compartments unitized into one body) is only 30" high in sizes as large as 13⅝" (12" Series 900)...Single is only 18½" high in same size. Smaller sizes even less!

• Unmatched simplicity in changing rams—simply unbolt two doors, change rams, close and bolt the doors. Rams are automatically aligned as doors are bolted shut!

• Completely Enclosed Design . . . Direct Hydraulic Drive . . . Quick-Draining Compartment Bottoms . . . these and other exclusive features make Shaffer Hydraulic Cellar Control Gates outstanding in the industry.

Available in a complete range of sizes and pressure ratings.

SHAFFER COMBINATION ROTATING BLOWOUT PREVENTERS AND STRIPPERS

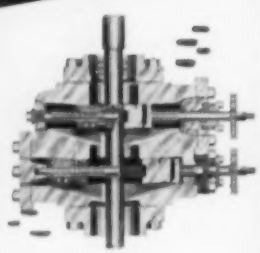
• Combine in *one* unit every necessary feature for complete pressure control while drilling.

• Maintain continuous seal around any element in the drill string — drill pipe, tool joints, kellys, drill collars, and couplings — *automatically*, whether string is rotating, being raised or lowered, or is stationary.

• Can be used with any standard kelly (square, hexagonal, or octagonal) — and any type of drill pipe (coupled, upset or flush). No special drill string equipment is required!

• Quick-Relrasing Bonnet permits passing bits, reamers, other large-diameter tools through the unit quickly and easily.

Available in 2 types —a complete size range!

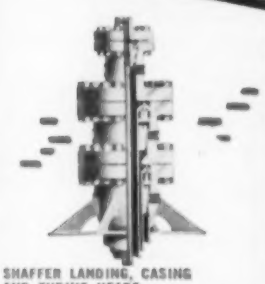


SHAFFER MECHANICAL CELLAR CONTROL GATES

• Available in both *Double* (illustrated above) and *Single* types for operation by an air motor drive utilizing the air supply available at most rigs — *plus manual stand-by protection!*

• Even in sizes as large as 13⅝" (12" Series 900) the Double type requires less than 29" cellar height, the Single less than 17½"!

• Rams are changed by simply removing one end cover . . . quick-draining ram compartments prevent accumulation of detrimental mud and sand . . . many other unique features make these gates top choice wherever *mechanically*-operated cellar control gates are preferred!



SHAFFER LANDING, CASING AND TUBING HEADS

• Meet every requirement for modern, compact casing and tubing suspension in wells of all depths.

• Available in various types and packing arrangements. Base Heads and Combination Base, Casing and Tubing Heads are available for combining several units into one where space is at a premium.

Shaffer also provides a full line of modern Tubing Heads, Multiple Zone Hook-Ups and other equipment to complete your pressure control installations.

SHAFFER ADJUSTABLE FLOW BEANS

• These units *pioneered* the adjustable flow bean principle and are still unequalled in operating features.

• Available with Conical, Micro and electrically-heated Thermo Tips in both regular and hard metal designs to meet various drilling, production and refining applications. A choice of all popular sizes — in both flanged or screwed connections!

ALSO SHAFFER FISHING TOOLS are world famous for their simplicity, dependability and unique advancements . . . tools that combine into **one** coordinated unit the operating principles of **several** different tools. Get full details from your nearest Shaffer representative. Or write direct!

SHAFFER

HIGH PRESSURE DRILLING AND CONTROL EQUIPMENT • FISHING TOOLS THAT EXCEL

SHAFFER TOOL WORKS, Brea, California • California Service Shops: Santa Fe Springs and Taft
HOUSTON, TEXAS, 6006 Navigation Blvd. • ODESSA, TEXAS, 1925 West Second Street
OKLAHOMA CITY, OKLAHOMA, Shaffer Tool Works, Post Office Box 546
FARMINGTON, NEW MEXICO, Shaffer Tool Works, Post Office Box 1788
CASPER, WYOMING, Shaffer Tool Works, 900 Fifth Avenue, New York, N. Y., U. S. A.
EXPORT SALES OFFICE: Shaffer Tool Works, 900 Fifth Avenue, New York, N. Y., U. S. A.

34 years OF OIL TOOL LEADERSHIP

transferred the manufacturing of the TI seismic equipment from Dallas to Houston. Texas Instruments is an outgrowth of Geophysical Service, Inc., the company formed in 1930 by Karcher and McDermott.

The new plant building was officially turned over to Robert W. Olson, president of HTL, by J. E. Jonsson, president of the parent firm, Texas Instruments.

Motorola Promotes Three In C & E Division

R. L. BORCHARDT

Robert L. Borchardt has been named manager of the technical information center of the communications and electronics division of Motorola, Inc. He succeeds Harold A. Jones who was promoted to director of sales of the C & E division earlier this year.

Frederick W. Alexander has been promoted from technical editor to advertising manager. Robert E. Newlin has been named to the newly created post of product-promotion supervisor.

Borchardt has been assistant manager of the department since 1954. Prior to that he edited one of the company's external semitechnical publications.

Before joining the company this year, Alexander spent 10 years with Automatic Electric Co. as assistant advertising manager. Newlin joined the company in 1950 and has been a technical editor and staff writer in the technical-information department.

National Supply Divides Canadian Operations

National Supply Co., Ltd., has divided its Canadian store operations into three districts. A. D. Foulds, district manager, will be in charge of the southern Alberta district, with headquarters at Calgary. Extending from Red Deer south to the United States border, this district includes all areas now covered by the company's stores in Calgary and Stettler.

R. M. Borden, formerly an assistant district manager, will manage the northern Alberta district, covering the area now served by the stores at Edmonton, Drayton Valley, and Redwater. Headquarters will be at Edmonton.

J. H. Linstead, also formerly an assistant district manager, will manage the Saskatchewan - Manitoba district, including the areas of the stores at Swift Current and Esteven, Sask., and

THIS IS THE STORY of three men and a VALVE. Joe, a chemical engineer, needed valves that could handle tough corrosives. Bill, a refining engineer was looking for valves that gave a positive shut-off. Tom, working for a large industrial firm, needed valves that sealed both upstream and downstream. All three solved their problems by specifying Hamer Visible Wedge Valves. These remarkable valves combine the double sealing action of precision metal-to-metal fit augmented by dependable seal rings. The wedges are trimmed with nickel, while seats are trimmed with stainless steel to withstand the roughest corrosive conditions. The full-view wedges are handwheel operated --can't blow out or drop on a toe. The wedges pivot so no lifting is necessary.

So if your plans require long service, sure-seal shut-off valves, by all means specify

HAMER VISIBLE WEDGE VALVES.

P.S. For descriptive literature, write:

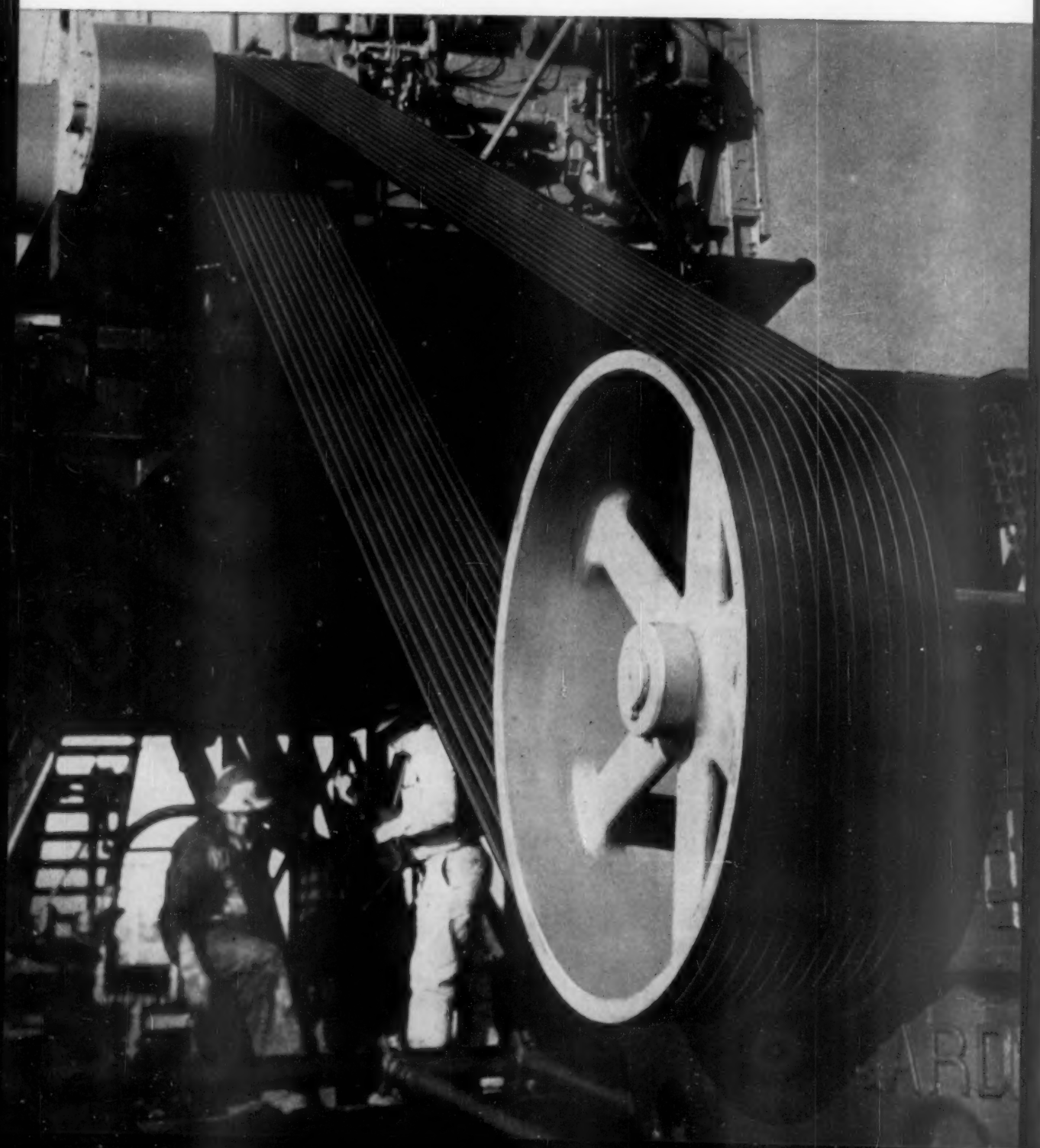
Hamer

VALVES, INC.

2919 Gardenia Ave., Long Beach 6, California

Representatives Throughout the World.

HOW MULTI-MATCHED DAYTON HELP YOU MEET DRILLING QUOTAS,



THOROBRED V-BELTS REDUCE COSTS

Continuous Trouble-Free Power Transmission Assured by Precision Matching of Every Set

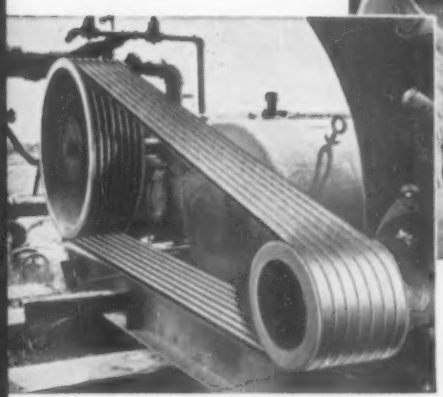
It's plenty tough getting a well down on schedule. The unexpected is the ordinary. So you'd be glad to eliminate just one cause of possible trouble — premature V-Belt failure due to mismatching.

When not accurately matched a few V-Belts in a set take all the strain — then snap without warning. And you're faced with a slow-down or maybe a complete halt in drilling at tremendous hourly costs. This can't happen with *Multi-Matched* Dayton Thorobreds.

Each Dayton Thorobred pulls its share of the load.

Dayton's are *matched several times over* — at the Factory, at Regional and at Field Warehouses on Dayton's exclusive Matchometers. You're assured the most precise matching possible for uniformly long service. You'll be able to count on steady, full power transmission to meet and beat drilling quotas when you've got sets of Dayton Thorobreds driving your mud pumps, draw works and those all-important auxiliary drives.

Order a set today from your nearby Field Supply Store for a trial on your roughest drive.



Every set of Dayton Thorobred V-Belts is *Multi-Matched* on precision Matchometers, the finest device made for matching V-Belts, built exclusively for Dayton Rubber Company.

© D.R. 1956

Dayton Rubber 51 YEARS OF PROGRESS

World's Largest Manufacturer of V-Belts

The Dayton Rubber Co., Industrial Replacement Div., Dayton 1, Ohio

Dayton V-Belts Available Through over a Hundred Oil Field Supply Points

DAYTON REGIONAL WAREHOUSES

Los Angeles, Calif.—909 East Slauson
Dallas, Texas—925 Slocum
Houston, Texas—1308 La Branch

DAYTON DISTRICT WAREHOUSES

California
Bakersfield—109 23rd St.
San Francisco—401 Howard St.

Louisiana
New Orleans—632 S. Peters St.
Shreveport—214 N. Market St.

Texas
Abilene—628-30 Walnut St.
Corpus Christi—1920 N. Port Ave.
El Paso—1701 Texas St.
Odessa—111 N. Lee St.
Pampa—159 S. Cuyler St.
Wichita Falls—1300 Indiana Ave.

FIELD STORE STOCKS

Arkansas
All Republic Supply Stores

California
All Bethlehem Supply Stores
Bakersfield—Power Transmission and Equipment Co.
San Francisco—H. N. Cook Belting Co.

Colorado
All Republic Supply Stores

Illinois
All Republic Supply Stores

Kansas
All Republic Supply Stores
Coffeyville—Acme Foundry Co.

Louisiana
All Republic Supply Stores
Lake Charles—
Behring's Bearing Service of La., Inc.
New Orleans—
New Orleans Belting and Bearing Co.
Oil City—Oil City Hardware Co.
Shreveport—Bearing Transmission Co.

Nebraska
All Republic Supply Stores

New Mexico
All Republic Supply Stores

Oklahoma
All Republic Supply Stores
Oklahoma City—Green Head Service Co.

Texas
All Republic Supply Stores
Abilene—Carpenter V-Belt Co.
Amarillo—Radcliff Supply Co.
Beaumont—Behring's, Inc.
Borger—Radcliff Supply Co.
Brownsville—Alamo Iron Works
Cisco—Walton Electric Co.
Corpus Christi—Alamo Iron Works
Bradley's Motor & Armature Works
Houston-Oil Field Material Co.
Stewart Dean Co.
El Paso—El Paso Saw & Belting Co.
Freer—Houston-Oil Field Material Co.
Houston—
Behring's Bearing Service Co.
Houston-Oil Field Material Co.
Kilgore—Jack Anderson Engine Co.
Lubbock—Lubbock Electric Co.
Bearing Specialists Co.
Lufkin—Lufkin Foundry & Machine Co.
Midland—Electric Motor Service Co.
Odessa—Duke Electric Co.
Pampa—Radcliff Supply Co.
Pearsall—Houston-Oil Field Material Co.
San Antonio—Alamo Iron Works
Wichita Falls—Mims Bearing Co.
Hornsby Heavy Hardware Co.

Wyoming
All Republic Supply Stores

We're building again . . . in order to give our friend, Joe Roughneck, faster service on API casing, tubing and line pipe.

When Lone Star Steel's fifth open hearth furnace is completed, production of steel will be increased 25 per cent. More, our new pipe mill facilities will mean an increased supply of urgently needed tubing.

Yes, Joe Roughneck . . . heart of the oil industry . . . can depend on Lone Star Steel. Lone Star is dedicated as a major supplier to the oil and gas industries.

Neighbor, wherever you are, specify Lone Star and we both get a good deal.

Lone Star STEEL COMPANY

LSS

EXECUTIVE-SALES OFFICES
W. Mockingbird Lane at Roper • P. O. Box 12226 • Dallas, Texas

DISTRICT SALES OFFICES
Houston, Texas | Midland, Texas | San Antonio, Texas
Tulsa, Oklahoma | Wichita Falls, Texas | Shreveport, La.

Virden, Man. Headquarters will be at Regina.

R. W. Burns is division manager. The National Supply Co., Ltd., is a wholly owned subsidiary of The National Supply Co., manufacturer and distributor of oil-field machinery equipment.

Baroid Appoints Jordan As Technical Director

DR. J. W. JORDAN

Dr. J. W. Jordan has been appointed technical director of all laboratory activities of the Baroid Division, National Lead Co. These laboratories were formerly designated as sales and service and research and development. Jordan will also continue his over-all supervision of the pilot plant, technical consultants, and fellowships.

R. E. Offeman has been named associate technical director, assisting Jordan with special projects and surveys, new products, and liaison with other departments. E. E. Huebotter has been appointed assistant technical director for drilling muds to supervise the drilling-mud laboratories. Jay P. Simpson has been made supervisor of the drilling-mud laboratories.

Dr. R. E. Fariss is appointed supervisor of the Bentone laboratories, which conduct research and development and field service on Bentones and allied products. Dr. J. L. McAtee has been named supervisor of the technical service laboratories which are responsible for analytical work, special problems, routine testing, and preparation of standard solutions, calibration of viscometers and similar devices.

Allied Tube Names Sales Representative

The appointment of Edward Thorney as technical sales representative to be located in Baton Rouge, La., has been announced by Allied Tube Corp. of Beaumont, Tex.

Allied Tube specializes in the distribution of heat exchanger and condenser tubes for all alloys. It is representative for Scoville Manufacturing Co., Pacific Tube Co., Michigan Seamless Tube Co., Republic Steel Co., and Bethlehem Steel Co.

Thorney has been associated with Revere Copper & Brass, Hudson Engineering Corp., and The National Association of Corrosion Engineers. He will work with the chemical, petroleum, and power industries in Louisiana,

100 bbl. or 10,000 bbl...

COLUMBIAN BOLTED STEEL TANKS ALWAYS FIT

...into your picture!

There's a Columbian Bolted Steel Tank to fit any of your requirements...and every Columbian Tank is designed and made to "fit up" tight! Columbian engineering and Columbian master-craftsmanship, plus the most modern machinery and best materials produce the precision tank plates and parts that make Columbian Tanks easier to erect, longer lasting and everlastingly tight.

HAVE YOU SEEN THIS most unusual book? It is not only a catalog but a handbook of information on what makes tanks tighter. WRITE FOR YOUR COPY TODAY!

COLUMBIAN STEEL TANK CO.
P. O. Box 4048-J Kansas City, Mo.

Call Your Nearest COLUMBIAN Distributor

COLORADO
O'Neill Tank Co.
Sterling, Colo.

KANSAS
O'Neill Tank Co.
P. O. Box 771
Great Bend, Kans.
Hays, Kans.
Hill City, Kans.

LOUISIANA
McGuffin Tank Co.
P. O. Box 724
Shreveport, La.
McClatchey Tank & Supply Co.
Lafayette, La.

NEW MEXICO
Allied Supply Co.
P. O. Box 217
Artesia, N. M.
American Tank & Steel Co.
P. O. Box 1177
Farmington, N. M.

OKLAHOMA
Continental Tank Co.
P. O. Box 5038
Farley Station
Oklahoma City, Okla.

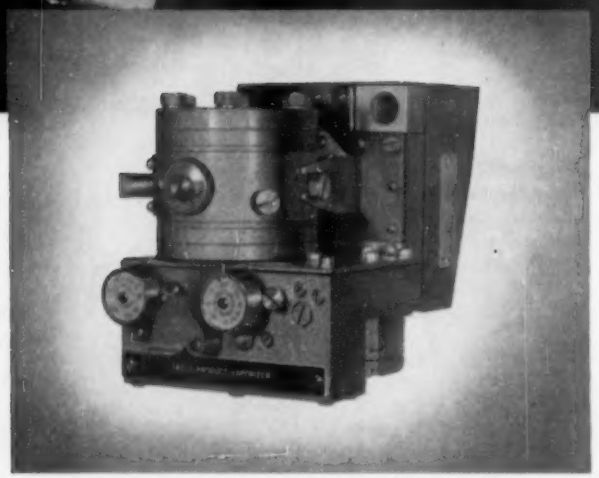
TEXAS
Gray-Brown Tank Co.
P. O. Box 924
Longview, Texas
Magee Tank Co.
P. O. Box 1349
Odessa, Texas
Martin Tank Co.
P. O. Box 135
Corsicana, Texas
Kilgore, Texas
Federal Tank Co., Inc.
First State Bank Bldg.
Bellaire, Texas
Texas Gulf Tank Co.
P. O. Box 14281
Houston, Texas
Westex Tank Co.
P. O. Box 941
Odessa, Texas
Columbian Steel Tank Co. (warehouse)
3705 McKinney Ave.
Houston, Texas
B. A. Box
P. O. Box 42
Beeville, Texas

TANKS FOR THE WORLD

Reg. U.S. Pat. Off.

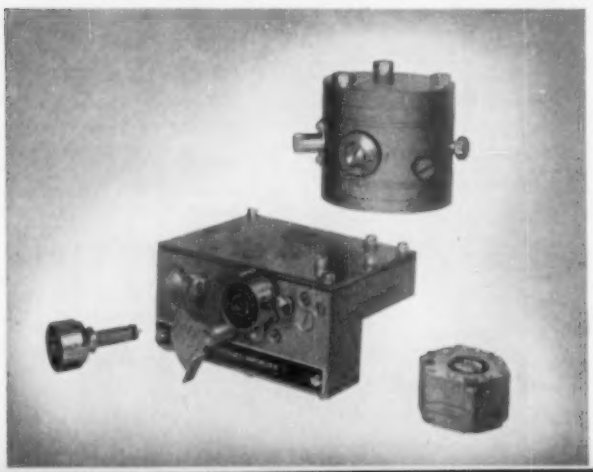
STEEL, Master-crafted by Columbian...First for Lasting Strength

Quick-connect mounting. Turning a quick-disconnect switch permits removal of controller. Process can then be manually controlled from front of panel.



All adjustments, filters and restrictions are accessible on the face of the controller.

Unitized construction permits easy replacement of all major components.



PROPORTIONAL-PLUS-RESET CONTROL

Tel-O-Set controllers incorporate two pneumatic chambers which receive two transmitted air pressures—one from a measuring unit, the other from a control-point-setting unit. They respond instantly to differences between the two transmitted air pressures by diaphragm movements which adjust the controlled air output to return the controlled variable to its set point.

control any process variable with one **TEL-O-SET** controller

THERE's just one model of the adjustable band *Tel-O-Set* controller . . . and you can use it to control flow, temperature, pressure, or any other variable. It has the speed of response, high sensitivity, and on-the-job versatility to simplify many control problems.

If necessary, you can remove one *Tel-O-Set* controller and replace it with another in a few seconds. Downtime is minimized. Maintenance is simplified. Your spare parts inventory is reduced. And you can easily change processing techniques without buying additional instruments.

Three reset ranges—Tune control action to suit any process with the *Tel-O-Set* controller . . . change the reset range to fast, intermediate, or slow—just by repositioning a single screw.

Compensated rate action—You can easily add rate action to the basic model . . . before the deviation section . . . so that overshoot on batch processes is held to an absolute minimum.

Unitized construction—Each component of the *Tel-O-Set* controller can be replaced with an identical precalibrated component. Needle valves and seats of proportional band and reset adjustments are entirely enclosed and cannot be damaged.

Quick-connect mounting—Mount the *Tel-O-Set* controller on the back of the recorder, on the valve, or anywhere between. A single lever opens or closes all interconnecting air lines . . . allows manual control after the controller is removed. The controller will match up perfectly with the flat, gasketed rear of the recorder.

Made by the world's largest instrument manufacturer, *Tel-O-Set* controllers have demonstrated outstanding performance in countless applications over the years. Call your nearby Honeywell sales engineer for a discussion of how you can profit by their many advantages. He's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS

First in Controls

Here's the **EASY WAY TO WELD**

Small Diameter Pressure Piping

USE W-S FORGED STEEL SOCKET-WELDING FITTINGS

In addition to providing high strength and toughness, W-S Forged Steel Socket-Welding Fittings are also easy to install. Deep sockets support and align the pipe for welding . . . eliminating the need for tack welding or special fixtures. No back-up ring is needed either. The fillet-weld is completely outside the pipe. Welding icicles just can't form inside the pipe. The result is a clean, tight welded joint that will readily resist high pressures and the stresses of shock and vibration. What's more, installation costs are lower.

W-S Socket-Welding Fittings are available in sizes ⅛" to 4" for schedule 40, 80, 160 and double-extra heavy pipe in carbon steel, stainless steels and alloy steels.

For complete information on the installation and operation advantages of W-S Forged Steel Socket-Welding Fittings, send today for Bulletin A-3-56.

W-S FITTINGS DIVISION

H. K. PORTER COMPANY, INC.

Roselle, New Jersey

Arkansas, and East Texas in solving condenser-tube problems.

Schramm Names McLaughlin To New Petroleum Division

McLAUGHLIN

The formation of a petroleum division to be headed by Philip L. McLaughlin has been announced by Harold J. Schramm, vice president of Schramm, Inc., West Chester, Pa. McLaughlin was formerly drilling editor, World Oil magazine, Houston, and more recently, director of drilling research, Cardwell Manufacturing Co., Wichita, Kans.

Schramm's new petroleum division will be a separate sales and research branch of the parent company but will use some of the existing dealer and sales organization to promote newly designed equipment. McLaughlin will coordinate the activities.

McLaughlin formerly served as an executive assistant to H. W. Cardwell, president of Cardwell Manufacturing, until its acquisition by John W. Mecom in January 1956. Under Mecom his duties were expanded from drilling research, advertising and sales promotion, to include market research director.

KelCo Increases Office, Manufacturing Space

Ben F. Kelley Co., Inc., has recently added 3,300 sq. ft. to its Tulsa facility, according to W. B. (Bill) Kelley, vice president and sales manager of the firm.

Additional manufacturing space was required to increase service to KelCo's expanding oil-field market and to make more efficient use of its modern equipment. Completely new and modern office space was incorporated into the expanded facility.

The company was founded in 1942 by Ben F. Kelley, Sr., with original shop and office space of 1,800 sq. ft. Including the current expansion, the new plant now covers 124,000 sq. ft. KelCo manufactures safety cat heads, safety power slips, and tubing tongs which are distributed throughout the world by major oil-field equipment suppliers.

National Supply Makes Executive Appointments

E. G. UNRATH

Ernest G. Unrath, formerly works manager of the company's Ambridge, Pa., seamless pipe mill, has been elected to the position of vice president, manufacturing, for The National Supply Co.; F. W. Bremmer, formerly vice president in charge of manufacturing, has been elected vice president, engineering; Joseph R. Mahan, formerly director of engineering, has been made director of research and engineering, which has been established as a separate function of the company, reporting directly to the president.

F. W. BREMMER

J. R. MAHAN

Unrath joined the Ambridge plant in 1931, and was active in new-product development before entering the hot-mill department as an assistant superintendent. In 1949 he was made works manager at Ambridge.

Bremmer joined the company's Ambridge plant in 1924. He rose from hot mill foreman to plant metallurgist and assistant superintendent of the hot mills. In 1940 he was appointed works manager of National Supply's Etna, Pa., plant, and in 1948, works manager of the Ambridge plant. He was elected vice president in charge of manufacturing for the entire company in 1949.

Mahan joined National Supply at its Torrance, Calif., plant in 1922. He later was transferred to the company's Toledo, Ohio, plant where he became district engineer. In 1944 he became director of engineering, which position he has held until his present appointment.

Oilwell Names Store Mgr., Field Representative

The appointment of James B. Mundy as field representative for U. S. Steel's Oil Well Supply Division at Healdton, Okla., and naming of Frank James, Jr., as manager of the Hill City, Kans., store have been announced by Mark

Here is a new full-revolving, stationary-mounted crane — the UNIT Mariner — specially designed for off-shore drilling operations. Conceived, developed and perfected by UNIT, the Mariner meets all requirements for cargo handling from a fixed mounting as applied to ships, barges or off-shore platforms. Unlike conventional cranes, the Mariner emphasizes unusual strength in turntable, roller path, rollers, hook shoes, boom and hoist mechanism.

A special, heavy-duty "A" frame permits capacity loads with extended boom at long radius. The famous UNIT sealed cast gear case serves as a protection against salt spray.

SAFETY is a major feature. Incorporated in the Mariner design, are positive and mechanical boom stops. These boom stops control the angle of elevation and prevent the boom from whipping back. Also the safety-promoting Full Vision Cab enables the operator to see what he is doing at all times. Load ratings are based on high factors of safety.

Yes, the Mariner is designed primarily for your type of cargo handling. Get the facts. Send for bulletin — NOW.

UNIT CRANE & SHOVEL CORP.

6327 W. Burnham St. • Milwaukee 14, Wis., U.S.A.

Geared to boost your earnings!

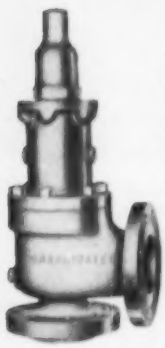
A 5002-35

GIANT

TIDEWATER REFINERY

PROTECTED

by Consolidated Safety Relief Valves



The world's most modern refinery will soon go on stream. It is the gigantic Delaware Flying A Refinery of the Tidewater Oil Company just 15 miles south of Wilmington. C. F. Braun & Co., engineering contractors, built the new plant on the 5000-acre site. Many of the processing units are unequalled for size and capacity anywhere. In around-the-clock operation, 130,000 barrels of crude of any kind can be processed daily. Tidewater engineers incorporated the most advanced design and equipment to provide the greatest flexibility, economy and safety.

Consolidated Safety Relief Valves are "sentinels of safety" in this mammoth "refinery of the future". Peak performance and consistently positive valve action are assured even where discharge lines are long or there is low "superimposed" back pressure in the relieving system. They provide the absolute protection so vital in petroleum processing and on product storage facilities.

Wherever Consolidated Safety Relief Valves are used, flexibility of application greatly reduces inventory costs. They are "2 in 1" valves. Interchangeability is so highly perfected that you can convert the Standard type to the Balanced Bellows Seal type *in the field* simply by installing a stainless steel sealing bellows. You can readily interchange these valves with those of other manufacturers: inlet and outlet center-to-face dimensions are standardized. Consolidated Safety Relief Valves also have fewer functional parts than comparable valves. The seating surface is optically-ground flat. From every standpoint, you can count on lower inventory costs and easy maintenance.

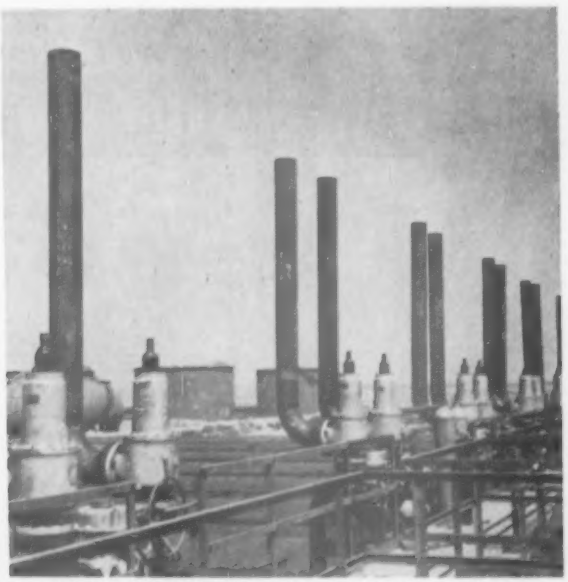
Write for full details about the complete reliability and all-around economy of Consolidated Safety Relief Valves. Both Standard and Bellows type are available in sizes and pressures to meet requirements today and tomorrow. Ask for Catalog 1900.

CONSOLIDATED SAFETY RELIEF VALVES

CERTIFIED AND APPROVED. Both Standard and Bellows Valves are approved under API-ASME and ASME Unfired Pressure Vessel Codes and are certified by the National Board of Boiler and Pressure Vessel Inspectors.

Tidewater Oil Company's "refinery of the future" has required nearly 7000 men in its construction. The enormous size of the installation can be gauged by the 500-foot high power station stack at the extreme left. To the right of the stack are, in order, the fluid coker, the sulphur recovery plant, the crude unit, the Orthoflow fluid catalytic cracker and other processing units. The Delaware Flying A Refinery's 7,000,000 barrel capacity "tank farm" is in the background. The refinery's processing units occupy 450 acres of the 5,000-acre site.

The Orthoflow catalytic cracker—the world's largest, with a daily capacity of 102,000 barrels—is equipped with Consolidated Safety Relief Valves.



Consolidated Safety Relief Valves also stand guard atop the propane storage bullets at Tidewater's Delaware Flying A Refinery.

A PRODUCT OF MANNING, MAXWELL & MOORE, INC.

TULSA, OKLAHOMA

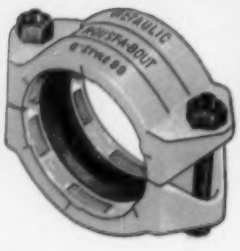
MAKERS OF 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'ASHCROFT' GAUGES, 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN-MICROSEN' INDUSTRIAL ELECTRONIC INSTRUMENTS, *Stratford, Conn.*, 'HANCOCK' VALVES, *Watertown, Mass.*, 'CONSOLIDATED' SAFETY RELIEF VALVES, *Tulsa, Okla.*, AIRCRAFT CONTROL PRODUCTS, *Danbury & Stratford, Conn. and Inglewood, Calif.*, "SHAW-BOX" AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES, *Muskegon, Mich.* **In Canada:** *Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario.*

VICTAULIC®

METHOD OF PIPING

VICTAULIC HAS EVERYTHING...

VICTAULIC COUPLINGS
Simple, fast, reliable. *Styles 77, 77-D,* for standard uses with steel or spiral pipe, — *Style 75* for light duty. Other styles for cast iron, plastic and other pipes. Sizes ¾" to 60".

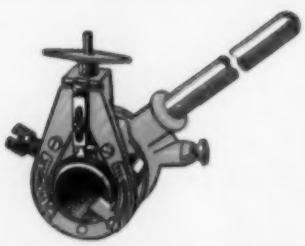


ROUST-A-BOUT COUPLINGS
For plain or beveled end pipe *Style 99.* Simple, quick, and strong. Best engineered and most useful plain end coupling made — takes a real "bull-dog" grip on the pipe. Sizes 2" to 8".

VICTAULIC SNAP-JOINTS
The new, boltless, speed coupling, *Style 78.* Hinged into one assembly for fast piping hook-up or disassembly. Hand locks for savings in time and money. Ideal for portable lines. Sizes 1" to 8".

COUPLINGS FOR EVERY PIPING JOB

VICTAULIC FULL-FLOW FITTINGS
Elbows, Tees, Reducers, Laterals, a *complete line*—fit all Victaulic Couplings. Easily installed — top efficiency. Sizes ¾" to 12".



VIC-GROOVER TOOLS
Time saving, on-the-job grooving tools. Light weight, easy to handle — operate manually or from any power drive. Sizes ¾" to 8".

PLUS FITTINGS AND GROOVING TOOLS

"EASIEST WAY TO MAKE ENDS MEET"

Promptly available from distributor stocks coast to coast.
Write for NEW Victaulic Catalog-Manual No. 55-E-11

VICTAULIC COMPANY OF AMERICA
P. O. BOX 509 • Elizabeth, N. J.

Barkhurst, Mid-Continent area manager of the division.

Mundy was employed by Oilwell in 1954 at Lindsay, Okla., where he was located prior to his present appointment. James joined Oilwell in 1952 at Oklahoma City. He later was transferred to Seminole, Okla., and in 1955 was appointed field representative at Pawhuska, Okla., holding this position prior to his present appointment.

Daniel Orifice Elects Griffin as President

W. A. GRIFFIN

Paul P. Daniel, chairman of the board, Daniel Orifice Fitting Co., recently announced the election of W. A. Griffin to the office of president.

Griffin joined Daniel in Los Angeles in 1940 and has been vice president and general sales manager since 1950. In his new post, he succeeds J. G. Holdenried who will become executive consultant.

With the appointment of Griffin, Daniel Orifice Fitting Co. has begun an expansion and development program. This will include an expansion of the Houston plant facilities and a transfer of executive offices from Los Angeles to Houston.

Napko Has New Four-Unit Plant in Houston

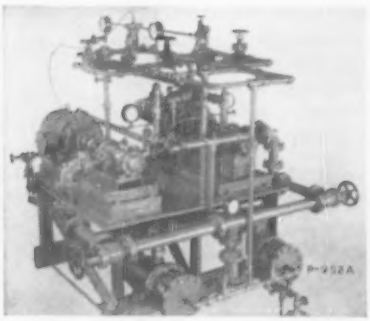
The new $500,000 Napko Corp. plant, located on an 8-acre site in Houston, provides 60,000 sq. ft. for plant, finished-goods warehouse, laboratory, and offices.

The office building houses executive offices and a research laboratory. The finished-goods warehouse contains 14,400 sq. ft. of space as well as shipping offices and stock rooms.

The three-story main plant building serves as the hub of the new multimillion-dollar Napko project. To the right of the main plant building is the resin plant.

COMPLETE RANGE OF SIZES AND MODELS IN BOTH MEDIUM AND HIGH PRESSURE TYPES

MORE COMPACT THAN EVER



P-952-A—Steam Turbine and Electric Motor drive gives flexibility in this compact Model P-ES2H size No. 25 unit.

NATIONAL AIROIL

FUEL OIL PUMPING AND HEATING UNITS

NATIONAL AIROIL Fuel Oil Pumping and Heating Units are specially designed to prepare, for combustion, all grades of fuel oil including No. 6 or Bunker "C" Oil and residuums. They will draw fuel oil from above ground or underground tanks, preheat it to proper constant temperature and deliver it to Oil Burners at an even pressure, best suited for the burners. Our Fuel Oil Pumping and Heating Units are the result of years of experience. They come completely equipped ready for steam, exhaust, condensate, oil suction, oil return and electrical connections. All valves, regulators, etc., are readily accessible. The piping arrangement is easily understood. These compact, space-saving units are available in a range of sizes and models in both Medium and High Pressure types. For complete details, write for our Bulletin 40 — very interesting and informative.

OIL BURNER and GAS BURNERS for industrial power, proces and heating purposes.
STEAM ATOMIZING OIL BURNERS
SLUDGE BURNERS, Steam Atomizing
MOTOR-DRIVEN ROTARY OIL BURNERS
MECHANICAL PRESSURE ATOMIZING OIL BURNERS
DUAL STAGE, Combining Steam and Mechanical Atomization
LOW PRESSURE OIL BURNERS
AUTOMATIC OIL BURNERS, for small process furnaces and heating plants
GAS BURNERS
COMBINATION GAS & OIL BURNERS
FUEL OIL PUMPING and HEATING UNITS
FURNACE RELIEF DOORS
OBSERVATION PORTS
SPECIAL REFRACTORY SHAPES

NATIONAL AIROIL BURNER CO., INC.

1236 E. Sedgley Avenue, Philadelphia 34, Pa.
Southwestern Division:
2512 South Boulevard, Houston 6, Texas

Harries Appointed Sales Agent for Web Wilson

Harries Sales & Rental, Inc., has been appointed sales agent for West Texas and eastern New Mexico for the complete line of Web Wilson Oil Tools, Inc.

W. A. HARRIES

J. L. BARNETT

W. A. (Bill) Harries, president, has spent many years representing Reed Roller Bit Co. and National Supply Co. through the Mid-Continent and Gulf Coast. J. L. (Barney) Barnett, vice president, formerly was associated with Baash-Ross in West Texas and on the Gulf Coast.

Harries Sales & Rental will have offices and a warehouse in Odessa, Tex.

Republic Promotes May to Ellinwood Store Manager

A. D. (Andy) May has been promoted by Republic Supply Co. to the position of manager of its Ellinwood, Kans., store as announced by W. J. McWilliams, vice president of operations and general manager of sales.

May joined the Republic organization in 1950 at Odessa, Tex., and since that time has been located at Kermit, Tex., Bartlesville and Pawhuska, Okla., in field and city sales work.

Hartop to Study Kent's Canadian Activities

Off on a visit across Canada and the United States is W. A. Hartop, works director of George Kent, Ltd. He plans to generally review the present status and progress of the Kent manufacturing subsidiary at Toronto, Kent-Norlantic, Ltd.

From Toronto he will go to Ottawa and Winnipeg and then to Vancouver, where in collaboration with Sealand Products, Ltd., Kent-Norlantic is building a sales and service system. Hartop will spend some time in Montreal where the same buildup of an engineering service for Kent instruments and controls is taking place. Qualified engineers have been sent during the past year to various centers in Canada to

For fuels and lubricants that deliver superior performance, specify

ENJAY PETROLEUM ADDITIVES

including

ENJAY PARANOX

detergent-inhibitor additives

and

ENJAY PARATONE®

viscosity index improver

ENJAY

Your only source for a complete line of diversified, high quality petroleum additives (Paramins®).

ENJAY COMPANY, INC.

15 W. 51st St., New York 19, N. Y.
Other offices: Akron • Boston • Chicago • Tulsa

Pioneer in Petrochemicals

provide engineering sales and after-sales service organization for Kent equipment throughout Canada.

Chemico Expands Into Petrochemical Field

Chemical Construction Corp. plans to expand its engineering design and construction services and will undertake projects in both the chemical and petrochemical processing industries. This was revealed recently by George Walker, president of Electric Bond & Share Co., who also indicated that recent acquisition of Chemico by his company provides for independent operation of the wholly owned subsidiary. Chemico specializes in the engineering and construction of chemical plants both here and abroad.

New projects announced by Chemico since its acquisition by Electric Bond & Share include two ammonia synthesis separation plants, a urea plant in Japan, and a plant for the production of ammonia sulfate from gypsum in Italy.

Frey Appointed to Dresser Pacific Northwest Area

The appointment of Fred Frey as sales representative in the Pacific Northwest area with headquarters in Portland, Ore., has been announced by Dresser Manufacturing Division, Bradford, Pa.

Frey will serve the users of Dresser pipe joining and repair products in the Northwest. Prior to his association with Dresser, Frey served in a sales capacity with Republic Supply of California.

It pays to get EVER-TITE Quality in Quick Couplings

There's an EVER-TITE for every need

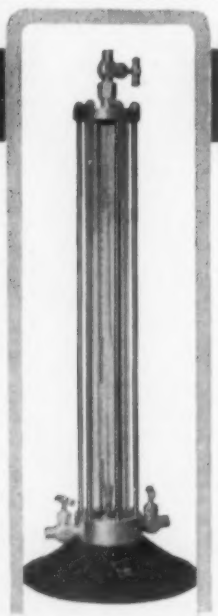
Superior quality forged body —precision machined
Uniform wall thickness —no weak spots
Extra heavy reinforcing rim for longer service life
Extra Hi-Strength forged handles —greater economy
Steel pins —greater safety and longer service
Uniform heavy wall thickness —no weak spots
Recess retains gasket in coupler and assures proper placement
Superior quality forged body —precision machined —accurate tolerances

EVER-TITE Couplings give you a quick, tight connection every time—under every condition. They make your deliveries fast . . . safe . . . dependable. Ever-Tite Couplings are manufactured of brass and bronze, aluminum, stainless steel and malleable iron.

It pays to get EVER-TITE quality—the top value in quick couplings. Ask your distributor now for full details.

EVER-TITE COUPLING CO. INC.
254 W. 54th St., New York 19, N. Y.

PRESSURE HYDROMETER JAR



For obtaining specific gravity of liquefied petroleum gases, such as propane and butane, which under normal atmospheric pressure would evaporate into a gaseous form. Jar withstands operating pressures of 200 psi at normal temperatures. Equipment consist of clear lucite tube, aluminum end caps held by tie-rods and a conical base. Three needle valves allow entry of the sample and adjustment of the liquid level.

N.G.A.A. METHOD NO. 2140-55

cenco
The most complete line of scientific instruments and laboratory supplies in the world.

REFINERY SUPPLY COMPANY
621 EAST FOURTH STREET ● TULSA 3, OKLAHOMA
2215 McKINNEY AVENUE ● HOUSTON 2, TEXAS

CENTRAL SCIENTIFIC COMPANY
1700 IRVING PARK ROAD ● CHICAGO 13, ILLINOIS
CHICAGO NEWARK BOSTON WASHINGTON DETROIT SAN FRANCISCO
SANTA CLARA LOS ANGELES TORONTO MONTREAL VANCOUVER OTTAWA

Weatherford Announces Promotions, Transfers

ADDISON LOVE

Addison Love recently joined Weatherford Oil Tool Co., Inc., as chief engineer and will be in charge of production research and design, present production improvements, and quality control.

J. T. Liner has been transferred from Weatherford, Tex., to Pampa where he is serving as division manager for the Panhandle area.

R. L. Wood, Abilene, Tex., has been

J. T. LINER

R. L. WOOD

promoted to western division assistant manager. He will handle West Texas and New Mexico areas.

Clyde Baumgardner, transferred to Houston from Casper, Wyo., has been appointed sales and service engineer for the headquarters area and export department. Garland Diggs, formerly district manager of Victoria, Tex., has been promoted to assistant division manager of the eastern division and transferred to New Orleans.

Gene Smith is the new district manager of the Wichita Falls, Tex., area, having been transferred from Nocona, Tex., where he served in the same capacity. Ralph Phillips is an addition to the Weatherford organization and services the surrounding territory of Fort Morgan, Colo.

Avondale's Harvey Plant Opens Machine Repair Shop

Avondale Marine Ways, Inc., New Orleans, has recently opened a machine shop at its Harvey plant. The new building is 60 by 180 ft., providing additional floor space for all types of oil-tool machinery repair.

The oil-tools department at the Harvey plant has been in operation 2 years. The unit specializes in all types of repair of oil-tool drilling equipment, giving prompt and expert workmanship at any hour of the day or night.

The Harvey plant of Avondale and the oil-tools department are under the direct supervision of Melton Garrett.

You will never be sad

with JEFFERSON gas scrubbing agents

monoethanolamine, diethanolamine — for sweetening natural and refinery gas

diethylene glycol, triethylene glycol — for dehydrating natural gas

Shipped from convenient distribution points at Port Neches, Houston, Chicago, Los Angeles, and Tenafly, New Jersey—available in tank cars, tank wagons, or 55-gallon drums.

For prompt service, call your nearest Jefferson representative.

Jefferson Chemical Company, Inc., Box 303, Houston 1, Texas.

Essential Chemicals from Hydrocarbon Sources

Jefferson CHEMICAL COMPANY, INC.

HOUSTON · NEW YORK · CHICAGO · CHARLOTTE · LOS ANGELES

BRIGHT PROSPECT FOR "PIPE DREAMS"

Drillers' "pipe dreams" are of rugged dependability. Producers' "pipe dreams" are of consistent high quality. Both are dreams of economy. And both could well be dreams of FBT seamless †casing, †tubing or †drill pipe whose in-the-field performance has won praise from qualified oil men. For outstanding service on outstanding tubular goods, contact Texcon for FBT.

*Finest Buy in Tubular Goods.

TEXAS CONTINENTAL TUBE COMPANY

Bank of Commerce Bldg. •FBT• Houston, Texas

fish
ENGINEERING
CORPORATION
HOUSTON, TEXAS

If you are considering new facilities in the oil, gas, chemical or allied industries, you can get valuable assistance from Fish Engineering Corporation and subsidiary companies. At Fish, you will find some of the finest economists, engineers and construction men in the world. They are ready to work with you every step of the way from feasibility studies through engineering, financing, construction and operation.

HOUSTON, TEXAS

Affiliated Companies

FISH SERVICE CORPORATION

FISH NORTHWEST CONSTRUCTORS, INC.

division manager of the Harvey quick-repair yard. Lamar Woodfin, assistant manager, heads the service itself. Other executive personnel of the department include John Baldwin and Dick Regan, assistants to Woodfin as sales engineers. Foreman of Avondale's oil-tools department is Sidney Jambois, formerly of Alexander Shipyards.

Pacific Pumps Elects New Sales Vice President

A. F. CANADA

A. F. Canada has been elected vice president in charge of sales, centrifugal pumps division, Pacific Pumps, Inc., it has been announced by A. R. Weis, president. Canada was formerly centrifugal pumps sales manager of the Huntington Park, Calif., company.

Canada joined Pacific in 1945, serving as manager of the Tulsa office and Mid-Continent regional manager until 1954, when he was appointed sales manager of the centrifugal pump division.

Stone & Webster Elects Connell as Vice President

Arthur J. Connell has been elected a vice president of Stone & Webster Engineering Corp., according to T. C. Williams, president of the corporation.

Connell, who has been active in petroleum and chemical projects, joined Stone & Webster in 1951. As a vice president and consulting engineer, he will continue to be engaged in the advancement of the interests and activities in the petroleum, chemical and petrochemical fields.

Allen Cathodic Opens Polyken Office in Tulsa

The opening of a new Tulsa sales office and warehouse facilities for Polyken protective coatings, a division of Kendall Co., has been announced by John C. McIntosh, general sales manager of Allen Cathodic Protection Co., Inc., Houston. Heading the Tulsa office will be R. N. Van Arsdale. Prior to becoming affiliated with Allen, Van Arsdale was with Marshall Supply & Equipment Co., Tulsa.

McIntosh stated that the opening of the Tulsa warehouse was to enable users of Polyken wrappings in the Oklahoma-Kansas-Missouri area to get immediate delivery on all orders.

Allen Cathodic has been serving the

Helicoid Gages

an ACCO product

Acaloy Flanged Case

Helicoid gages set new standards of enduring accuracy, trouble-free service, and economy

Acaloy Flangeless Case

Phenol Turret Case

Acaloy Flush Case

Acaloy Square Flush Case

Industry has found in the HELICOID Gage, the most durable and efficient instrument ever devised to meet pressure-indicating requirements.

No Gears—No Teeth to Wear Out!
The exclusive HELICOID Movement is a simple, gearless cam-and-roller design with no teeth to wear out. It provides long and trouble-free service with a minimum of maintenance.

Sustained Accuracy—Longer Life
Because of advanced design, quality control in manufacture, and endless testing, HELICOID Gages produce more sensitive response to pressure changes. Their accuracy *endures*—even after millions of cycles.

Lowest Cost per Gage per year
These gearless gages go on performing day in and day out with little or no maintenance. This economy, together with long life, adds up to the fact that HELICOID Gages cost less per gage per year than any other gage you can buy.

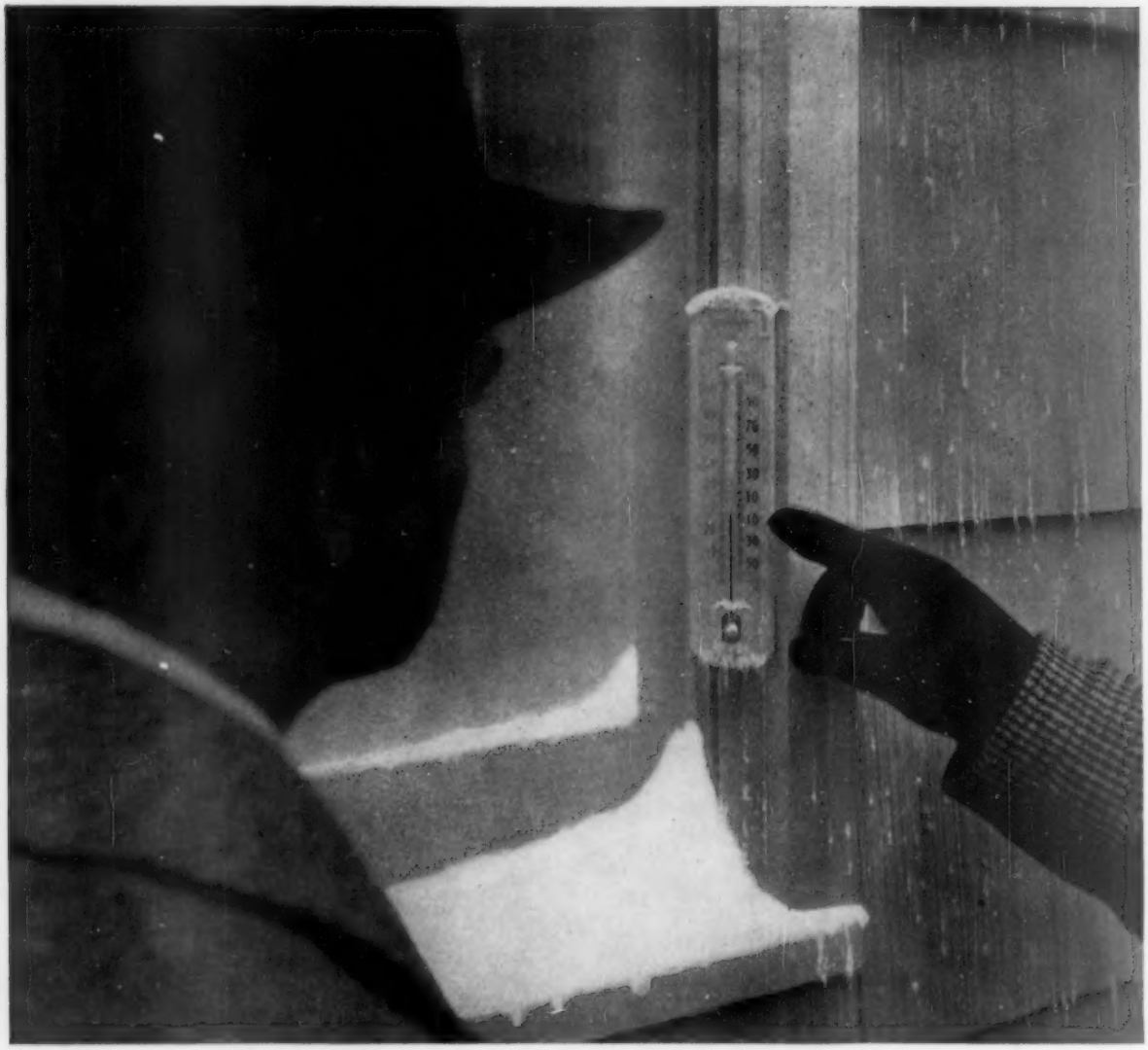
Gages for vacuum and compound service. Pressure ranges up to 20,000 psi.

The Helicoid Movement

ACCO

Helicoid Gage Division
AMERICAN CHAIN & CABLE
929-A Connecticut Avenue • Bridgeport 2, Connecticut

for Better Value



"Cold weather reminds me of what Pritchard did at Tioga!"

"What has Pritchard got to do with the weather? And where or what is Tioga?"

"Pritchard had plenty to do with the weather! You mean I've never told you about Tioga?"

"No, you haven't. What is it?"

"Tioga is a place in North Dakota where Signal Oil and Gas Company has its new natural gasoline plant. Now, that's where Pritchard really went to work! They designed and engineered the whole plant. They sure had a tough weather problem to whip!"

"Was it bad?"

"Bad? I'll say so! Down to minus 40 degrees or less in the winter and then up to 110 in the summer. You know how they solved it?"

"How?"

"Dry distillation! They didn't use a bit of steam in the gasoline recovery process. Imagine, gasoline recovery without using any steam. You know, I'm not too surprised."

"What makes you say that?"

"I know Pritchard. They cut their eye teeth on problems like Tioga."

J. F. PRITCHARD & CO.
4625 Roanoke Parkway, Kansas City 12, Mo.

"Cold weather reminds me of what Pritchard did at Tioga!"

Dry Distillation Features Signal's Tioga Plant—Designed and Engineered by Pritchard

Signal Oil and Gas Company's new Tioga, North Dakota natural gasoline plant features dry distillation, with no steam used in the gasoline recovery process.

The entire plant was designed and engineered by Pritchard.

This plant was designed for extremely cold weather operations, with temperatures —40° F. or below in the winter: up to 110° F. in the summer.

Just another in the long parade of successful installations, the Signal plant is further proof that Pritchard designers and engineers have the skill to design facilities for you.

Contact Pritchard immediately for full details!

FREE TIOGA BROCHURE!

TIOGA

Write today for free Tioga Brochure. This beautiful brochure tells a fascinating picture story of the entire Tioga installation. Here's a book you'll want to keep. Get it by jotting a note on your company letterhead. No obligation whatever.

INDUSTRY'S PARTNER FOR PROGRESS

J.F. Pritchard & Co.
ENGINEERS • CONSTRUCTORS
Dept. 493, 4625 Roanoke Parkway
Kansas City 12, Mo.

SERVING THE GAS, POWER, PETROLEUM AND CHEMICAL INDUSTRIES
BOSTON, CHICAGO, BUFFALO, HOUSTON, NEW YORK, PITTSBURGH

pipeline and petroleum industries for the past 6 years. With offices in Houston, Memphis, Harvey, La., and Tulsa, they handle all types of corrosion-protection equipment as well as perform corrosion-engineering services.

Lane-Wells Names Keener Foreign Sales Coordinator

R. W. KEENER

Russell W. Keener, has been appointed coordinator, foreign sales and service, Lane-Wells Co., one of the Dresser Industries, according to James D. Hughes, vice president, sales and service.

Keener was vice president and one of the organizers of Petro-Tech Service Co. handling Lane-Wells services and products in Venezuela in 1946. Prior to that time he had been with Lane-Wells since 1941 in administrative duties and as purchasing agent.

Britt Heads Procon's Chemical Plants Division

James R. Britt has been appointed manager of the chemical plants division of Procon, Inc., according to an announcement by C. B. Whyte, president.

Britt has been with Fabricated Steel Products, Waskom, Tex., and prior to that with Cities Service Oil Co. as staff executive of the manufacturing department.

Greer Hydraulics Appoints A. N. Colby, John Farley

Archie N. Colby has been appointed general sales manager of Greer Hydraulics, Inc., and John Farley has been named director of the newly formed marketing department. Farley formerly was director of public relations. In his new capacity, he will be responsible for all marketing activities of the company, including market research, sales planning and sales policies, advertising, sales promotion, publicity, technical-service publications and institutional public relations.

Colby formerly was a senior associate with the management consulting firm, Bruce Payne & Associates of Westport, Conn. Prior to his work in management consulting, Colby was with Johns Hopkins University operations research office as operations analyst and section chief.

Before joining Greer in January 1956, Farley was an account executive

it's what's **inside** that counts

THE EFFICIENCY OF
Luber-finer
PATENTED PROCESS
PACK
HAS NEVER BEEN EQUALLED

STANDARD of the INDUSTRY SINCE 1936

DON'T BE MISLED BY PRICE ALONE!

There is no substitute for DIESELPAK'S Patented Filtering Process for H.D. Compounded oils AT ANY PRICE. The DIESELPAK cleans more oil faster—keeps it CLEAN longer—and gives more service and better engineered protection than any other filtering element. It PAYS to get the BEST!

√ Protects engine
The DIESELPAK is designed to remove not only ABRASIVES but also CONTAMINANTS such as moisture, carbon, acid, etc., from oil, and is engineered to keep the **filtering media** and the **removed contaminants** from migrating back into engine.

√ Extends periods between drains
The DIESELPAK collects and holds even the most finely dispersed contaminants without affecting or removing compound additives from the oil. A glance at the dip stick will show that the oil is CLEANER —symbol of better lubrication and longer oil life enjoyed only by Luber-finer users.

√ Takes less oil
The DIESELPAK because of its engineered construction requires 2 to 4 quarts less oil than spongy substitute filter elements being offered for use in the Luber-finer housing. This is an additional saving enjoyed when using the DIESELPAK.

LUBER-FINER PACKS AVAILABLE:

1. REFINING PACK—Introduced to the public in 1935 for use with straight mineral oils, fuel oils, hydraulic oils, and inhibited industrial oils.

2. DIESELPAK—First made available in 1941, the DIESELPAK was primarily designed for use with H. D. detergent compounded oils and has also achieved outstanding results when used with fuel oils and straight mineral oils.

Write for complete information to Dept. 91

LUBER-FINER, Inc.
2514 S. Grand Ave., Los Angeles 7

Simple plan tests wire rope performance and costs—shows comparative values—helps reduce operating expenses—speeds reordering.

Leschen's quick-fact-finding Service-Score System utilizes easily applied, easily removed pressure sensitive stickers, which record equipment and rope data, dates of rope installation and removal.

What is your *true* wire rope cost? Do you know? Are you using the right rope type or construction? The right brand?

Questions like these are readily answered with Leschen's new Wire Rope Service-Score System. Service-Score stickers report performance—type versus type, brand versus brand. Performance facts reveal costs and help *cut costs.*

Service-Score stickers provide easily-available, *helpful reordering data*—wire rope diameter, length, construction, date installed, and date removed.

Service-Score stickers remind operators when it's time to replace rope—*increasing safety* margins.

Service-Score records enable you to check and compare wire rope types and constructions. For example, you find for yourself, as others have, that Red-Strand consistently scores high. You learn the advantages of super-strength Porter Imperial Red-Strand, or Hercules Flattened Strand.

Write for sample stickers. Or see your nearby Leschen Wire Rope distributor.

LESCHEN
Red-Strand
WIRE ROPE
HKP
H. K. PORTER COMPANY, INC.

Keep the score and you'll use it more
Red-Strand Wire Rope

LESCHEN WIRE ROPE DIVISION
H. K. PORTER COMPANY, INC.
St. Louis 12, Missouri

in the marketing and merchandising division of Kenyon & Eckhardt, New York City advertising agency.

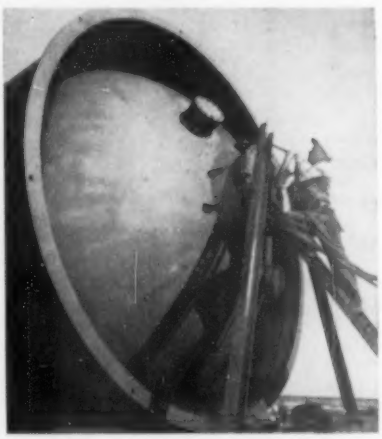
Detroit Diesel Expands Sales and Service Staffs

The Detroit Diesel Engine Division of General Motors Corp. has expanded its administrative sales and service facilities by establishing regional operations in six key cities throughout the country.

In charge of the new regional areas are the following managers: L. A. Steele, New York; R. W. Phillips, Atlanta, Ga.; J. C. Campbell, Detroit area with offices at Wayne, Mich.; D. E. Schwendemann, Chicago area with offices in Oak Park, Ill.; Eric Sutton, Dallas; and R. L. Burpee, San Francisco. These men have all held key posts at the home office in Detroit.

In announcing the expansion program, Robert E. Hunter, general sales manager, said the new regions would expedite and provide additional assistance to distributors, dealers, and equipment manufacturers. Headed by a regional manager and staffed by sales, sales engineering, service and office personnel, each office will provide a basis for coordinating all sales and service efforts in the region.

Nooter Delivers Sovaformer Spheres to Socony Mobil



Three huge steel spheres like this one fabricated by Nooter Corp. will give the St. Louis area one of the largest refining units in the country for upgrading the performance characteristics of gasoline to meet the requirements of the increasingly powerful engines being built into new automobiles.

The spheres, each weighing 60 tons and measuring 14 ft. 2 in. in diameter, will become the principal components of a Sovaformer unit, expected to go into operation in January at Socony Mobil Oil Co., Inc., refinery in East St. Louis.

Wheeler and Chenault Promoted by B S & B

The promotion of Richard H. Wheeler to manager of engineering, controls division, Black, Sivalls & Bryson, Inc., has been announced by C. A. Siver,

R. H. WHEELER

H. L. CHENAULT

vice president and general manager of the controls division. Harvey L. Chenault has been promoted to manager of engineering, steel products division, according to William C. McCool, vice president and general manager of the steel products division.

Wheeler, who will headquarter in Tulsa, has been chief engineer of the steel products division in Kansas City for the past 2 years. In his new position, he will be responsible for all engineering and development work on the full line of control valves, pilots and regulators.

Chenault, who served as assistant manager of the B S & B oil-field division's Oklahoma City plant prior to his recent promotion, has had over 20 years' experience in engineering and manufacturing at B S & B.

Lincoln Electric Awards Contract to Austin Co.

Contracts for a $5,500,000 building addition to The Lincoln Electric Co.'s 20-acre plant have been awarded to The Austin Co., engineers and builders of the existing plant.

Austin executives, who collaborated with James F. Lincoln, chairman of the company, said that the 456,000-sq.-ft. addition will be ready for occupancy in the fall of 1957. According to William Irrgang, president of Lincoln, the Austin contract represents the largest single commitment in the $8,000,000 expansion program announced by the company earlier this year.

The new space will be added by extending the existing structure 540 ft. to the east and 300 ft. to the west.

Griggs Co. to Represent Rust Engineering Texas

M. K. Griggs Co., Inc., Houston, will serve as Texas representative of The Rust Engineering Co. of Pitts-

IVERSON
SUPPLY COMPANY
30th ANNIVERSARY

FASTEST
SUPPLY STORE SERVICE
IN THE SOUTHWEST . . .

FIRST
in the
SNYDER,
TEXAS
Area

CHECK WITH IVERSON
whatever your requirements

In the center of the West Texas fields the IVERSON SUPPLY STORE in Snyder, is a dependable and convenient source of supplies for all Drilling and Production Equipment.

IVERSON'S Snyder, Texas store provides round-the-clock service - - - customers' orders are filled with speed and efficiency. And, all equipment handled is backed by the IVERSON Guarantee of Satisfaction.

IVERSON SUPPLY STORES

OKLAHOMA — Oklahoma City, Okmulgee, Tulsa.
NEW MEXICO — Artesia, Farmington.
TEXAS — Kermit, Odessa, Sherman, Snyder.

30th Anniversary
IVERSON SUPPLY CO.
1926 ——— 1956

OFFICES: FT. WORTH, DALLAS & MIDLAND, TEXAS

IVERSON SUPPLY COMPANY
DRILLING-PRODUCTION AND REFINERY EQUIPMENT
GENERAL OFFICES
P. O. BOX 1439 TULSA 1, OKLA.

OFFICES: DENVER, COLORADO TULSA, OKLAHOMA

BAKED-ON PLASTIC COATINGS

PREVENT CORROSION—CONTROL PARAFFIN

Use PLASTICAP Coatings for protection against corrosion and control of paraffin in these applications:

GAS LIFT WELLS — Prevent water-dependent corrosion . . . eliminate shutdowns for corrosion control and paraffin scraping . . . reduce the co-efficient of friction in tubing.

GAS CONDENSATE WELLS — By protecting against corrosion, PLASTICAP Coatings provide the margin of safety needed in high pressure wells.

SALT WATER DISPOSAL AND WATER FLOOD SYSTEMS — Save pipe . . . eliminate the possibility of plugging perforations or formation with by-products of corrosion . . . give an increased volume over uncoated pipe.

HIGH PRESSURE SWEET CRUDE WELLS — Control corrosion caused by water, scale, CO_2 and organic acids.

SOUR CRUDE WELLS — Resist H_2S (Hydrogen sulphide) . . . eliminate embrittlement of pipe.

PUMPING WELLS — PLASTICAP Coatings resist deposition of paraffin on rods, tubing and flow line . . . end rod stripping jobs . . . eliminate steaming of lines . . . reduce overall cost of paraffin control.

COMPLETE CORROSION CONTROL SERVICES

FILL OUT AND MAIL COUPON . . .
for complete information on corrosion control services. PLASTICAP Baked-On Tubular Coatings, PLASTICAP Custom Coatings and Rubber Linings will save money in many services.

PLASTIC APPLICATORS, INC.
P. O. BOX 7631 HOUSTON 7, TEXAS PHONE UN-9-2491

Please send information on:
PLASTICAP Tubular Coatings ☐ PLASTICAP Custom Coating ☐ Rubber Linings ☐

NAME _____

COMPANY _____

ADDRESS _____ CITY _____ STATE _____

TWO PLANTS TO SERVE YOU
HOUSTON, TEXAS HARVEY, LOUISIANA

burgh, Pa., Birmingham, Ala., and Boston, Mass.

As principals of the Houston firm, Mark K. Griggs, president and founder, Burton W. Wallin, vice president, and James H. Lyman, sales engineer, will be active in all phases of Rust Engineering's diversified industrial sales operations. The area served by the Griggs company will include the eastern half of Texas.

Griggs has over 40 years' experience in engineering, operation of steel-fabricating plants, and industrial sales.

Wallin joined Griggs in 1951 following service with Tube Turns, Inc., Houdaille Hershey Corp., Guiberson Corp., and McArdle Equipment Co. Lyman joined the company in 1955 as a sales engineer. Prior to that, he was with General Metals Corp.

Peerless Pump Appoints Richter and Ries

The appointment of Max H. Richter, Jr., of New Orleans, and George Ries, of Cleveland, Ohio, as sales engineers has been made by B. A. Tucker, sales manager, Peerless Pump Division, Food Machinery & Chemical Corp., Los Angeles.

Richter will handle sales of the company's engineered vertical and horizontal pump lines in Louisiana and Arkansas. Ries has a similar assignment for the State of Ohio.

Dresser Names Zippro, Vance to Sales Posts

The appointment of Cornelius Zippro as sales representative in the Southeast area and naming of Thomas L. Vance as southwestern sales representative for the gas industry have been announced by Dresser Manufacturing Division, Bradford, Pa.

Prior to joining Dresser, Zippro was with South Jersey Gas Co. and Yarnall Waring Co. His new headquarters will be in Atlanta, Ga. For the past 3 years, Vance has represented Dresser in southern California. In his new position, he will serve the Texas, Louisiana, Arkansas, and New Mexico area from headquarters in Dallas.

Porter Names Gurley

Sam Gurley, Jr., has been elected to the post of vice president of sales for H. K. Porter Co., Inc., according to T. M. Evans, president.

Until recently, Gurley held a similar position with Reichhold Chemicals, Inc., and previously had executive positions with Borden Co.'s chemical division and the Barrett division, Allied Chemical & Dye Corp.

It takes a complete team to keep dependable drilling mud service available for you

Meet this Magcobar Man, who runs a school . . . he's a scientist, a teacher, a mud engineer.

The Laboratory Training Instructor is a well rounded Magcobar man. He's a highly trained technician, he's worked in the field as a mud engineer, he's abreast of the latest developments in mud research and he's a teacher. This is the man that puts the final polish on the mud engineers before they complete their training in the field. He teaches them how muds are compounded and why—what chemicals to use, how to formulate the proper combination of weighting materials and chemicals under all types of drilling conditions. In short, how to take care of any conditions that will arise in your drilling operations. The laboratory training instructor is a vital key in the Magcobar organization that has more than 400 men in the field furnishing the oil industry the most complete drilling mud service in the business.

MAGNET COVE BARIUM CORPORATION

Houston, Texas

Magcobar
Complete
DRILLING MUD SERVICE

A MATTER OF RECORD

In July, 1924, the Halliburton Oil Well Cementing Company was incorporated as an oil well *service* company. Under its charter, the corporation is prohibited from engaging in the business of oil developing, producing or refining. This is a matter of record.

Since its inception, the Halliburton Oil Well Cementing Company has been dedicated solely to the policy and purpose clearly stated by Erle P. Halliburton, its founder and chairman:

> "To render useful service to the oil industry at a reasonable price . . . uniform quality of service regardless of location . . . a never-ending program of energetic research . . . constant development of new equipment . . . or, briefly, to maintain leadership in our chosen field."

SERVICE . . . service beyond the fee . . . *service above all* is the basic purpose to which Halliburton has been exclusively devoted for nearly a third of a century . . . clearly demonstrated by the successful completion of over three million well service jobs and thirty-three years of continuous research. This is also a matter of record.

The necessary, important, closely integrated services performed by Halliburton are "*all for oil.*" They have but one point and purpose . . . to put more oil in *your* tanks . . . to increase *your* profits.

HALLIBURTON

OIL WELL CEMENTING COMPANY

DUNCAN, OKLAHOMA

251 SERVICE CENTERS – JUST MINUTES AWAY FROM ANY RIG

Arkansas Proves a Point

by Frank J. Gardner

IT isn't often that Arkansas makes oil news today. But it made some last week . . . quietly. The state is such an old timer in oil circles that most folks tend to overlook it in the feverish campaigns of newer and more exciting provinces.

A discovery event that should **not** be overlooked occurred in Ouachita County. Though the initial potential on the new strike was small, its geological implication looms large. At the point flagged on the map, David Crow, Tr. 1 Boyce was finished on a ¼-in. choke for 60 bbl. per day of 34°-gravity crude oil from the Smackover lime at 5,943-48 ft.

A geologist goes to work . . . Now Smackover wells are no novelty in Arkansas. But Smackover crude in a fault trap **is.** And the Boyce well pierced a fault trap. Its success bears out a prediction that appeared in The Oil and Gas Journal on June 11, 1956. In a piece called "South Arkansas Sees Rosy Future," Geologist Ernest J. Murdoch flatly stated that . . . "The future possibilities of Smackover production associated with fault traps cannot be ignored." Unlike most authors of prediction pieces, Geologist Murdoch went to work to prove his theory. And he has.

There was only one faulted Smackover pool in existence in Arkansas prior to the Boyce discovery, and that was a gas-condensate reserve at Fouke field in Miller County. It was found by Carter Oil Co. Co. in 1955 at its 1 Silberberg. The discovery well made 108 bbl. of condensate per day, gas-condensate ratio 13,981:1, through 15/64-in. choke, from Smackover perforations at 9,021-28 ft.

To test a theory . . . Now comes the first crude oil at Crow 1 Boyce, from a much shallower depth, to prove a theory and fulfill a prediction. It was Murdoch who did the geology and put the deal over. He has signaled a new direction to Arkansas oil finders.

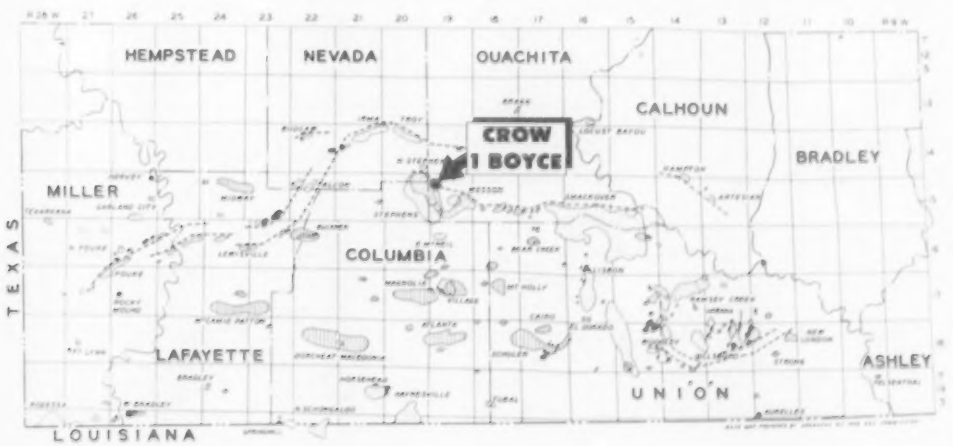
The Boyce strike lies on the northeast edge of the old Stephens oil field along a regional fault trend as shown on the map. It was drilled on a 500-acre block in Sections 6 and 7-15s-19w. Only four Smackover tests had ever been made in the vicinity of the well. Its success pins down the eastern extremity of a trend that begins at Mexia, Tex., and it should stimulate subsurface thinkers to greater efforts all along the line.

The Smackover lime has been a prolific source of oil for Arkansas—about 303 million barrels of reserves are estimated for the formation in all fields there. But there's been no major Smackover discovery since Midway field in 1942. The Boyce discovery points up additional possibilities, however, despite its small flow. A program of subsurface reexamination and reshooting with the new seismic tools that were unknown in early-day Arkansas exploration might well turn up these possibilities. Sedimentation and tectonic studies would help, too. For the lime that was cored at Crow 1 Boyce is not the typical oolitic lime of high permeability that Arkansawyers are used to; rather, it's a cellular, microcrystalline lime with secondary porosity and microfractures. Its porosity runs 20 to 27 per cent, and permeability only 25 md. Crow did not acidize his well for completion, however. A residual oil saturation of 13 to 27 per cent of pore space has been determined, and a water saturation of 10 to 15 per cent.

And prove a point . . . While it cannot be said, then, that Crow 1 Boyce is exactly a gusher, it is definitely a forward step in Arkansas exploration. There's little doubt that here, as in most old oil regions, a lot of oil lies yet undiscovered in deeper traps and in new types of traps. The point is proved by an examination of the record in Arkansas over the past few years. In 1955, there were 789 wells completed, 31 per cent over 1954; wildcat successes increased from 8 in 1954 to 55 in 1955, and development successes from 63 per cent in 1954 to 73 per cent in 1955.

This year, Arkansawyers have finished 849 wells already, to top the 1955 record. Of these, 557 have been oilers (447 in 1955), 10 have been gassers (11 in 1955), and 282 have failed (331 in 1955). Of these, 165 were wildcats, and 39 of them hit, for a success ratio of nearly 24 per cent, a little above the 23 per cent of last year.

Discouraged? Not Arkansas. They'll continue to make oil news over there . . . quietly.



SUCCESS at David Crow, Tr. 1 Boyce, in Ouachita County, Arkansas, has found the first Smackover oil in a fault trap in that state. One previous fault field found gas and condensate in the Smackover.

Exploratory drilling pays as . . .

Montana Boasts Fabulous Oil Reserves

Most of Montana's pay zones are in the reserve category of 100-200 bbl. per acre-foot of pay or the 2,500-6,000-bbl. per acre class. Primary reserves to January 1, 1956, totaled 354,050,000 bbl.

WHAT are Montana's oil reserves? How good are the state's pay zones? What will each zone ultimately produce? These are only a few questions that the Oil and Gas Conservation Commission of the State of Montana answers in its Annual Review.

Today Montana has proved recoverable reserves of 354 million barrels of oil. Five new fields discovered in 1955 added 38 million barrels of oil to the state's growing reserves. Extensions and revisions added another 42 million barrels.

Exploratory drilling according to the report is rewarding. Each foot of hole drilled in the state added 42½ bbl. of new reserves to the state's total.

Reservoirs

Best pay zone in the state is the Madison limestone at Elk basin. The Conservation Commission estimates that the Madison will ultimately produce 32,700 bbl. of primary oil per acre. But Poplar has the largest oil reserves in the state, 107,297,000 bbl. Its closest rival, Elk basin, has less than half this figure.

Montana's reservoirs are not prolific and certainly do not fall in the same class as the Miocene sands of the Gulf Coast nor the Ellenburger of West Texas. Most of Montana's pay zones are in the reserve category of 100-200 bbl. per acre-foot of pay or the 2,500-6,000-bbl. per acre class.

The Madison at Poplar is well above average with 6,640 bbl. per acre at a drilling depth of 5,550 ft.

Cretaceous sands . . . Principal Cretaceous reservoirs are the Shannon, Frontier, Colorado, and Kootenai. Drilling depths to these zones varies greatly, ranging from 1,100 ft. to the Kootenai at Cat Creek to 6,900 ft. to the Frontier at Clark's Fork. Cretaceous sands are found in many parts of the state, but there are only a handful of fields producing from these zones.

Jurassic . . . The Ellis at Bannatyne and Cat Creek, and the Morrison at Ivanhoe are the two most important Jurassic sands. Neither of these sands contains large known reserves, although recoveries from these sands can be good, based on the performance at Cat Creek. At Ivanhoe, however, the ultimate recovery is estimated at only 1,508 bbl. per acre.

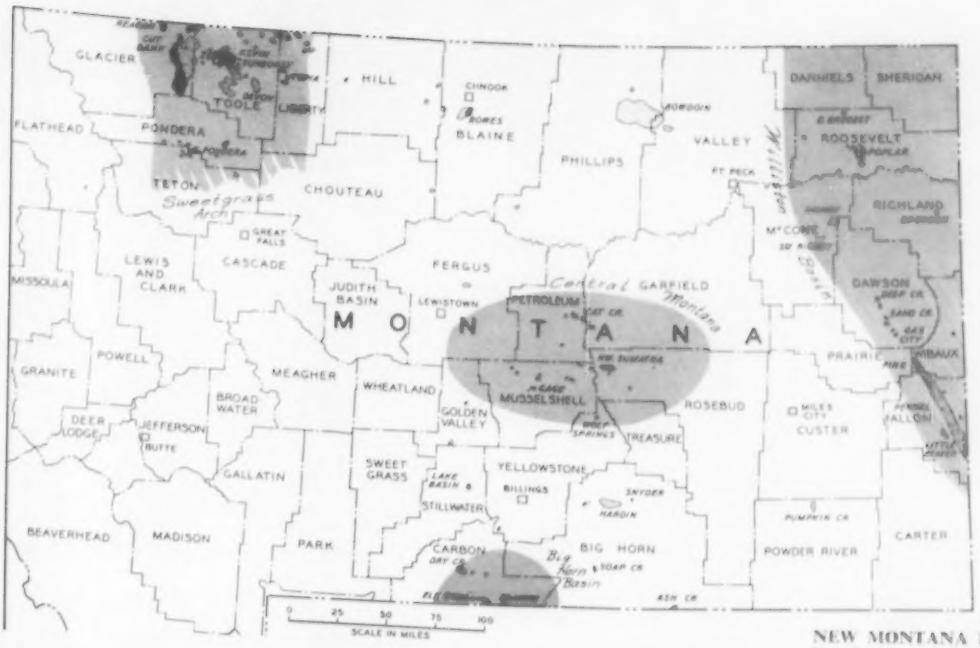
Pennsylvanian . . . At the present time, the Tensleep is the only important Pennsylvanian producer in the state. At Elk basin, the Embar-Tensleep zone will ultimately produce 21,600 bbl. per acre. This figure is much larger than the estimated recovery from the Tensleep at nearby Frannie where the ultimate recovery will be only 2,920 bbl.

Mississippian . . . The Amsden is becoming more important as an oil reservoir in Central Montana. Recent discoveries at Wolf Springs and at Ivanhoe have emphasized the oil possibil-

SUMMARY of basic engineering data and estimate of proved primary reserves in Montana oil fields as of January 1, 1956.

Field	County	Year Discovered	Producing Formation (1)	Approximate Depth (2)	NO. OF Producing 1/1/56 (3)
Ash Creek	Big Horn	1952	Shannon (U. Cret.)	4,700	4
Bannatyne	Teton	1927	Ellis (Jurassic)	1,450	2
Berthelote	Toole	1929	Sunburst (Kootenai)	2,422	1
Bears Den	Liberty	1924	Ribbon (Kootenai)	2,300	3
Big Wall	Musselshell	1948	Amsden ss. (U. Miss.)	3,000	15
Big Wall	Musselshell	1953	Amsden ls. (U. Miss.)	2,500	11
Border	Toole	1929	Kootenai (L. Cret.)	2,400	4
Bowes	Blaine	1949	Sawtooth (Jur.)	3,250	74
Brady-Midway	Pondera	1943	Kootenai (L. Cret.)	1,450	5
Bredette	Roosevelt	1955	Charles-Mad. (L. Miss.)	6,550	2
Brorson	Richland	1953	Red River (Ordov.)	12,585	1
Brorson	Richland	1954	Madison (L. Miss.)	9,000	2
Cabin Creek	Fallon	1953	Silurian-Ordov.	8,300	20
Cat Creek	Petroleum-Garfield	1920	Kootenai (L. Cret.)	1,100	42
Cat Creek	Petroleum-Garfield	1945	Ellis (Jurassic)	1,400	43
Clark's Fork	Carbon	1954	Frontier (U. Cret.)	6,900	1
Cupton	Fallon	1955	Red River (Ordov.)	9,800	2
Cut Bank	Glacier-Toole	1922	Kootenai (L. Cret.)	2,950	960
Cut Bank	Glacier-Toole	1946	Madison (L. Miss.)	3,100	139
Deer Creek	Dawson	1952	Red River (Ordov.)	9,850	6
Devils Basin	Musselshell	1919	Heath (U. Miss.)	1,200	2
Dry Creek	Carbon	1930	Cloverly (L. Cret.)	5,800	6
Elk Basin	Carbon	1915	Frontier (U. Cret.)	1,200	19
Elk Basin	Carbon	1942	Ember-Tensleep	4,900	30
Elk Basin	Carbon	1944	Madison (L. Miss.)	5,350	9
Fertile Prairie	Fallon	1954	Red River (Ordov.)	9,200	3
Flat Coulee	Liberty	1928	Colorado (Cret.)	1,500	1
Frannie	Carbon	1928	Tensleep (Penn.)	2,700	2
Gage	Musselshell	1943	Amsden (U. Miss.)	6,000	1
Gas City	Dawson	1955	Silurian-Ordov.	8,400	3
Glendive	Dawson	1952	Stony Mtn.-Red River	8,700	12
Golden Dome	Carbon	1953	Lakota (L. Cret.)	5,850	1
Ivanhoe	Musselshell	1953	Morrison (U. Jur.)	2,800	2
Kevin-Sunburst	Toole	1922	Sunb.-Ellis-Mad.	1,500	1,394
Lake Basin	Stillwater	1925	Dakota (L. Cret.)	3,800	2
Little Beaver	Fallon	1952	Stony Mtn.-Red River	8,300	4
Little Beaver, East	Fallon	1954	Stony Mtn.-Red River	8,300	2
Melstone	Musselshell	1948	Amsden (U. Miss.)	4,250	4
Mosser	Yellowstone	1936	Frontier (U. Cret.)	1,000	4
Pennel	Fallon	1955	Siluro-Ordov.	8,800	2
Pine	Fallon-Wibaux	1952	Siluro-Ordov.	8,400	43
Pondera	Pondera-Teton	1927	Madison (L. Miss.)	2,100	314
Poplar	Roosevelt	1952	Charles-Madison	5,550	73
Poplar, Northwest	Roosevelt	1952	Charles-Madison	6,200	5
Ragged Point	Musselshell	1947	Kibbey (U. Miss.)	4,400	3
Reagan	Glacier	1947	Madison (L. Miss.)	3,200	42
Richey	Dawson-McCone	1951	Madison (L. Miss.)	7,000	7
Richey, Southwest	McCone	1952	Siluro-Ordov.	9,220	2
Richey, Southwest	McCone	1952	Devonian	9,130	1
Sand Creek	Dawson	1952	Interlake (Silurian)	9,000	2
Snyder	Big Horn	1952	Tensleep (Penn.)	4,550	3
Soap Creek	Big Horn	1920	Amsden (U. Miss.)	1,825	13
Soap Creek	Big Horn	1923	Madison (L. Miss.)	1,925	10
Sumatra	Rosebud	1955	Amsden (U. Miss.)	4,000	4
Sumatra	Rosebud	1949	Heath (U. Miss.)	4,500	51
Whitlash	Liberty-Toole	1927	Colorado (Cret.)	1,400	22
Wibaux	Wibaux	1954	Red River (Ordov.)	11,000	1
Wolf Springs	Yellowstone	1955	Amsden (U. Miss.)	6,200	2
Woodrow	Dawson	1952	Charles (L. Miss.)	7,800	1
Woodrow	Dawson	1953	Red River (Ordov.)	10,160	1
Yellowstone	Dawson	1953	Red River (Ordov.)	8,800	1
					3,441

*Approximated.

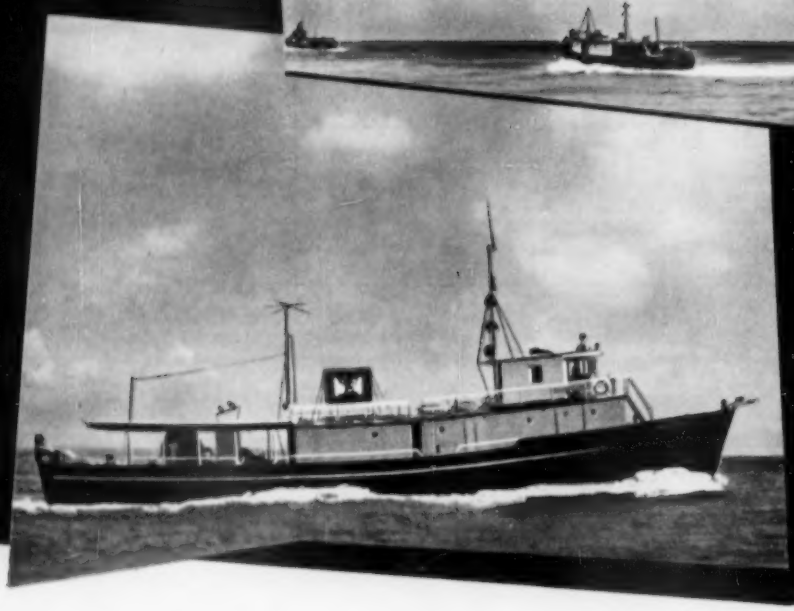


NEW MONTANA FIELDS added 38 million barrels of oil to reserves in 1955.

WELLS Completed in 1955 (4)	A. P. I. Gravity (5)	Formation Volume Factor (6)	Net Pay Thickness Feet (7)	Porosity Percent (8)	Connate Water Percent (9)	Stock Tank Oil in Place Bbls. Per Acre (10)	Estimated Proven Acres (11)	Total Stock Tank Oil In Place In 1000's Bbl. (12)	Estimated Primary Recovery Percent (13)	Ultimate Primary Recovery In 1000's Bbl. (14)	Cumulative Production To 1/1/56 In 1000's Bbl. (15)	Primary Reserves 1/1/56 In 1000's Bbl. (16)	Ultimate Primary Recovery Bbl. acre (17)	Ultimate Primary Recovery Bbl. acre-ft. (18)
0	34	1.045	13	22.5	35	14,100	160	2,260	20	452	136	316	2,820	217
0	27	----	39	----	----	----------	60	----------	----	56*	56	----------	----------	----------
0	36	----	35	----	----	----------	40	----------	----	73*	17	56	1,830	52
0	38	1.08	20	12.	35	11,200	80	895	15	134	75	59	1,680	84
2	31	1.02	22	17.	40	17,100	540	9,213	35	3,225	2,281	944	5,980	272
5	19	1.02	17	16.	35	13,450	220	2,960	25	740	188	552	3,360	198
0	31	1.08	22	15.	30	16,600	300	4,980	25	1,245	1,045	200	4,150	189
1	19	1.00	22	12.	45	11,300	2,170	24,500	25	6,120	4,101	2,019	2,820	128
0	35	----	----	----	----	----------	200	----------	----	22*	12	10	----------	----------
2	40	1.24	19	6.	56	3,140	960	3,010	50	1,505	40	1,465	1,570	83
0	32	1.809	20	8.9	49	3,900	160	625	40	250	125	125	1,560	78
1	48	----	80	----	----	----------	160	----------	----	928*	50	878	5,800	73
10	33	1.242	94	11.	30	45,100	2,440	110,000	30	33,000	909	32,091	13,500	144
0	49	1.00	50	18.	40	41,900	960	40,100	35	14,050	----------	----------	14,600	293
0	52	1.00	25	18.	40	21,000	880	18,450	35	6,460	18,738	1,772	7,340	293
0	46	----	28	----	----	----------	80	----------	----	169*	46	123	2,120	76
1	33	1.50	90	13.	35	39,300	640	25,100	12	3,020	13	3,007	4,720	52
21	38	1.083	15	15.	35	10,450	48,790	511,000	18	91,900	----------	----------	1,880	125
8	38	----	----	----	----	----------	5,470	----------	----	19,100*	79,778	31,222	----------	----------
0	42	1.21	112	6.7	35	31,200	480	15,000	24	3,600	619	2,981	7,500	67
0	34	----	----	----	----	----------	80	----------	----	25*	25	----------	----------	----------
1	51	----	----	----	----	----------	880	----------	----	6,009*	3,509	2,500	6,820	----
0	42	----	95	15.	30	77,300	120	9,260	25	2,320	----------	----------	19,300	204
0	30	----	164	10.5	35	86,700	1,376	119,000	25	29,800	20,557	42,263	21,600	132
0	28	----	225	11.6	35	131,000	940	123,000	25	30,700	----------	----------	32,700	145
3	34	1.25	49	5.6	30	11,900	320	3,800	24	913	51	862	2,850	58
0	31	----	14	----	----	----------	80	----------	----	78*	23	55	975	70
0	27	----	39	----	----	----------	160	----------	----	466*	323	143	2,920	75
0	33	----	33	----	----	----------	280	----------	----	474*	454	20	1,695	51
3	38	----	45	----	----	----------	640	----------	----	4,480*	38	4,442	7,000	155
0	39	1.25	177	7.0	35	50,000	1,040	52,000	24	12,450	2,083	10,367	12,000	68
0	52	----	12	----	----	----------	40	----------	----	47*	35	12	1,175	98
0	29	1.14	10	15.	41	6,040	120	724	25	181	49	132	1,508	151
24	32	1.083	6.5	20.	35	6,019	40,045	241,063	30	72,319	61,072	11,247	1,806	278
1	44	----	22	----	----	----------	280	----------	----	560*	468	92	2,000	91
2	29	1.16	37	12.	35	19,300	590	11,400	12	1,370	287	1,083	1,835	50
1	30	1.20	52	12.5	35	27,300	420	11,500	5	575	34	541	1,370	26
0	34	----	25	----	----	16,950	240	4,068	25	1,017	864	153	4,237	169
0	22	----	15	----	----	----------	200	----------	----	227*	115	112	1,135	76
4	31	1.135	60	12.6	30	36,100	1,920	68,400	24	16,650	22	16,628	8,660	144
27	34	1.17	40	11.5	30	21,400	6,800	145,000	30	43,500	1,858	41,642	6,420	160
9	34	----	15	----	----	----------	4,300	----------	----	19,351*	12,251	7,100	4,500	300
20	40	1.10	35	11.	30	19,000	17,334	330,000	35	115,000	7,703	107,297	6,640	190
0	40	1.10	16	10.3	45	6,400	400	2,560	30	770	110	660	1,920	120
0	34	----	28	----	----	----------	140	----------	----	567*	410	157	4,050	145
2	38	----	15	----	----	----------	1,800	----------	----	4,100*	1,630	2,470	2,280	152
0	39	1.203	53	----	----	----------	900	----------	----	1,980*	673	1,307	2,200	42
0	48	1.37	21	9.	35	6,950	300	2,080	35	730	----------	----------	2,440	116
0	48	1.37	6	9.	30	2,140	300	644	35	225	305	650	750	125
0	38	1.37	15	6.9	35	3,800	320	1,218	----	3*	3	----------	----------	----------
0	21	1.16	12	14.	35	7,300	100	730	30	218	113	105	2,180	182
2	17	1.04	12	15.	35	8,700	150	1,300	25	326	----------	----------	2,170	180
4	20	1.05	18	15.	35	13,000	200	2,600	25	650	453	523	3,250	180
4	29	1.1	8	20.	35	7,330	160	1,170	25	292	18	274	1,825	228
8	32	1.16	30	18.5	35	24,100	2,140	51,600	20	10,300	2,785	7,515	4,820	161
1	38	1.13	15	21.	35	14,000	1,920	26,900	25	6,720	766	5,954	3,500	234
0	33	----	20	----	----	----------	80	----------	----	107*	14	93	1,335	67
2	30	1.07	23	3.6	25	4,520	4,250	19,150	50	9,600	23	9,577	2,260	98
0	32	1.4	19	17.3	35	11,800	160	1,890	10	189	----------	----------	1,180	62
0	40	1.5	33	6.0	35	6,660	160	1,065	5	53	17	225	331	10
0	38	----	24	----	----	----------	80	----------	----	57*	28	29	715	30
169							156,555			581,448	227,398	354,050		

Specialized to serve you better!

From the shot point to you, your seismic surveys are handled by specialized equipment and personnel to provide you with faster, more accurate data.



Oil City is one of many specially designed boats in the fleet of modern seismic survey boats operated by O. Ex.

- **Complete Unified Service** ... management, interpretation, research, maintenance, in fact all modern facilities are concentrated under one roof in our new building.
- **New Accurate Floating Cables** ... with specially designed pressure phones to give increased penetration and more accurate recordings.
- **Magnetic Recordings** ... are available on request for your specialized requirements.
- **Data Reduction** ... to save you time and money, and to give you accurate information.
- **Reynolds Cross-Section Plotter** ... may be used to correlate your sectional data in a hurry.
- **Experienced Crews** ... are now working in both foreign and domestic waters.
- **The Finest Fleet of Seismic Boats** ... modern steel boats, specially designed for offshore seismic exploration.

OFFSHORE EXPLORATION GROUP

2711 Timmons Lane • Houston, Texas • Phone MA 3-0481

APTDO 463 • Edificio Republica • Caracas, Venezuela • Tel: 5-6541

For more accurate, speedier marine seismic surveys, call in the specialist ...

GROUP

ities from this part of the Mississippian section. Both Amsden sands and limestones or dolomites produce.

Recoveries are not high for either the clastic or the carbonate rocks, falling in the 2,000 to 3,000-bbl. per acre class. This creates a problem in developing the zone at Wolf Springs where the Amsden occurs at a drilling depth of 6,200 ft. Operators have turned to 80-acre spacing in developing the field to insure a profit and would prefer to develop this type of reservoir on 160-acre spacing in view of low recoveries.

With the discovery of Heath-sand production at Sumatra, operators are looking at this zone more carefully as a possible pay. It is present in central Montana and only recently oil has been found in the Heath at Ivanhoe.

Madison . . . Probably the most important pay zones in Montana now are the carbonate rocks of Lower Mississippian age. Generally referred to as the Madison, these rocks are present over much of the state except where stripped off by erosion following the effects of the Laramide revolution.

Recoveries from the Madison vary considerably. Apart from Elk basin, the ultimate recoveries from the Madison fall in the 2,000-6,000-bbl. per acre bracket. At Elk basin, porous dolomites are oil-bearing and the zone is 225 ft. thick. Here the principal pay zone in the Madison is a part of the Mission Canyon formation and occurs 100-200 ft. below top of Madison.

Deeper pay zones . . . The Red River produces in eastern Montana on several known structures. Reservoir data, however, indicate fairly low recoveries from a deep pay zone. The unfavorable economics are a serious deterrent to active exploration for this reservoir—unless it can be developed along with some deeper or shallower horizon. Dual completions under such conditions make the Red River more attractive.

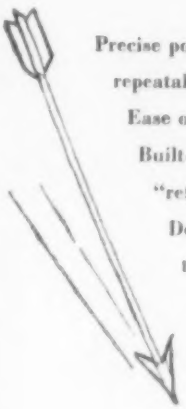
The Siluro-Ordovician section produces at Pine, Richey, Cabin Creek, Gas City, and Pennel and will outstrip the Madison as a pay zone in this part of the Williston basin. Although recoveries range from a low of 2,440 bbl. per acre to a high of 13,500 bbl. per acre, the average for this area is 7,600 bbl. per acre. This compares to the average Madison recovery of 6,760 bbl. per acre for the state.

Acknowledgment

The statistical data for this article appears in the Annual Review for the year 1955 issued by the Oil and Gas Conservation Commission of the State of Montana. Copies of this report may be obtained by writing directly to the Oil and Gas Conservation Commission, P. O. Box 217, Helena, Mont.

the precise position...

. . . is that the results of any survey are as accurate as the technique used . . . that savings in time and man power cut survey costs and so increase the area covered . . . that on these accounts, mobile Decca Chains have proved *in the field* to be the most efficient and flexible of all electronic position fixing techniques.



Precise position fixing with low ambiguity and true repeatability over long or short periods.

Ease of operation.

Built-in electronic referencing, eliminating "reference buoys".

Decca operates irrespective of height or terrain—the same Chain can be used by ships, aircraft, vehicles or ground parties.

Automatic and continuous map display of track and position with the Decca "Track Plotter".

THE DECCA NAVIGATOR

Mobile Chains for Survey and Exploration

THE DECCA NAVIGATOR COMPANY LTD. LONDON, ENGLAND

EXPLORATION

MID-CONTINENT

OKLAHOMA

Important Discoveries Still Dotting State

Exploration in Oklahoma continues its fast, significant, and successful pace as the last few weeks of the drilling year roll by. Important drilling activity is reported in all corners of the state, particularly in the Panhandle and northwestern region, the Cumberland-Ardmore trend, the Criner district of McClain County in the south-central portion, and the southwest.

McClain area . . . Gene Goff and Goff-Leeper Drilling Co. have an important Ordovician discovery in south-central Oklahoma at 1 Little, NW SE 4-5n-3w.

This discovery flowed 84 bbl. in 1 hour from the Tulip Creek sand at 9,792-9,800 ft.; from Bromide sand perforations at 9,610-22 ft. it flowed 12 bbl. per hour. From the Siluro-Devonian Hunton lime it made 40 bbl. per hour after acid from perforations at 9,130-60 ft.

Another significant Ordovician discovery in this area is Weimer, Fitzhugh, and Pyramid Oil Co. 1 Hanley, SW NE 5-5n-3w. This Bromide and Hunton discovery flowed 18 bbl. per hour from the Bromide sand at 10,192-10,202 ft. From the Hunton at 9,130-60 ft. it made 40 bbl. per hour.

. . . Criner district. Several operators are busy in the Criner district in 5n-3w and 6n-3w. Cox, Sunray, Atlantic, Goff-Leeper, Phillips, and Gulf all plan increased activity. This section of Oklahoma is currently the busiest.

Cumberland - Ardmore . . . A recent shallow new-pay discovery at Aylesworth by Blackwell Zinc Co. promises increased activity. The 7 University of Tulsa discovery found several pay zones above 6,403 ft. The well flowed 18 bbl. of oil per hour from the Tulip Creek sand at 4,574-89 ft.

The entire trend from Ardmore to Cumberland in southern Oklahoma can look for increased wildcat and development work. It is hoped that many new Ordovician reservoirs similar to Madill lie in this region. The coming months will see this section of Oklahoma one of the nation's important prospecting regions.

Panhandle-Northwest . . . The Harper County boom continues unabated in northwestern Oklahoma. Coupled with similar discoveries to the west in Beaver County, this section of the state is No. 2 in activity and promise.

Cabot Carbon 1 Ryser in NE SW 9-3n-28eCM, Beaver County, flowed 40,000 M.c.f. of gas per day from 4,450-83 ft. in the Hoover sand, and 3,000 M.c.f. from the Chester-Missisippian at 7,318-33 ft. Eason Oil Co. and Wilcox Oil Co. have a very noteworthy strike at 1 Price in NE SW 21-26n-23w, Harper County. This Tonkawa-Pennsylvanian discovery flowed 8 bbl. of oil per hour from 5,495-5,508 ft. The same operators also have a good Chester gas discovery at 1-C Hovey

Exploration this week

Mid-Continent	366
Eastern Interior	371
Appalachian	372
Hugoton Embayment	373
West Texas	375
Great Lakes	376
Western Canada	379
Pacific Coast	380
Rocky Mountain	381
Ark.-La.-Tex.	383
South Texas	384
New Mexico	387
Southeastern States	388
Successful Wildcats	389

"I'm eatin' out today."

diamonds . . . crown jewels for drilling

D&S and Truco diamond coring and drilling equipment has fast earned the reputation of the Royal Family in the oil field. Oil operators are realizing royal savings, too, because of faster coring and drilling penetration, cleaner holes, core recoveries at any strata, and time and money saved on every job. Write or call today! A D&S sales engineer is ready to analyze your diamond needs and explain the many D&S advantages.

Drilling & Service

DIAMOND DRILLING EQUIPMENT
6210 NORTH CENTRAL EXPRESSWAY | DALLAS, TEXAS
OFFICES IN ALL PRINCIPAL OIL AREAS

BP GOES TO ANTARCTICA

THE TRANS-ANTARCTIC Expedition is being supplied with petroleum fuels and lubricants exclusively by The British Petroleum Company.

Sir Edmund Hillary, leader of the New Zealand Party, is here seen driving a tractor, while his second-in-command, Mr. Bob Miller, supervises the unloading of aircraft fuel at the stores dump near Shackleton Base.

The British Petroleum Company is proud of its association with the Expedition—a tribute to the high quality of all products marketed under the BP Shield throughout the world.

The BP Shield is the symbol of the world-wide organisation of

The British Petroleum Company Limited

BRITANNIC HOUSE · FINSBURY CIRCUS · LONDON, E.C.2

ALTEN
PUMPING UNITS

PUMPING
PUMPING

PUMPING
PUMPING

PUMPING
PUMPING

PUMPING
PUMPING

PUMPING their way to Leadership

Thousands of Alten units—operating for years with low, low cost records—are pumping their way to leadership. Put them to work for you!

A full line of 47 models and types including small beam balanced units, beam and crank balanced models, or medium and larger types with the Alten screw-type adjustable counter balance. You can be sure of peak performance with every model in each series.

Ask at your local supply store or write Alten for latest catalogue and engineering information.

Worldwide Distribution Through Supply Stores

-ALTEN-
Foundry & Machine Works, Inc.
LANCASTER, OHIO

in SW NE 36-25n-23w. The well flowed 2,800 M.c.f. per day.

The second outside Hugoton field Permian discovery in recent months was accomplished by Carter Oil Co. at 1 State-Hodges in East Forgan field, SW SW NE 4-5n-24eCM. The Council Grove gas strike flowed 11,400 M.c.f. per day from perforations at 3,313-23 ft. The same well also is a Pennsylvanian-Morrow well at 6,258-78 and 6,305-13 ft., making 1,155 M.c.f. per day.

Noble Discovery Details Released by Operator

Information on successful drill-stem tests at Anderson-Prichard Oil Corp. 1 Allison, Bromide sand discovery near Noble in Cleveland County, has been released.

The wildcat recovered 7,900 ft. of clean oil and 30 ft. of mud-cut oil on drill-stem test in the upper Bromide sand at 7,870-7,930 ft. Recovery on drill-stem test at 8,215-25 ft. in the Tulip Creek sand was 8,135 ft. of clean oil and 90 ft. muddy oil.

Springer Discovery Flows at High Rate

A high flow rate was reported on initial production test of a Springer sand discovery in Grady County's Knox-Chitwood fold area. Frankfort Oil Co.'s 1 Burrus-Pyle, SW SE 23-4n-6w, flowed 50 bbl. of oil per hour from 10,585-99 ft. open hole.

Centrahoma Well Has Big Oil Flow

A lower Oil Creek sand oil well in Centrahoma pool, Coal County, southeastern Oklahoma, was completed flowing 306 bbl. in 2 hours on ⅜-in. choke, natural. The prolific producer is Carter Oil Co. 2 Claytor, SW NW SW 27-2n-9e. The above flow was through perforations at 6,892-96 ft. From perforations at 6,864-86 ft. it flowed 163 bbl. in 1¾ hours on ¼-in. choke.

Southwest Wakita Gas Area Adds Oil Well

Barrett Petroleum and Kay County Gas Co. have an oil strike in Southwest Wakita gas field, Grant County, northern Oklahoma. The 1 Lewis-B, NE SW NW 34-28n-7w, flowed 15 bbl. of oil in 4 hours on 21/64-in. choke from Mississippi Chat at 5,025-46 ft. This well extends the field to the northeast. The field discovery well, 1 Lewis, C NW SE 33-28n-7w, flowed 4,750 M.c.f. of gas and 15 bbl. distillate per million from perforations at 4,972-5,020 ft.

Woods County Wildcat Flows Misener Oil

Gulf Oil Corp. has an indicated oil discovery at its 1 Shade in SE SW 31-25n-14w, Woods County, northwestern Oklahoma. The wildcat flowed 20 bbl. of oil in 1 hour on a drill-stem test at 7,117-46 ft.

Grady County Discovery Nearing Completion

Frankfort Oil Co. and Humphrey Oil Co. are nearing completion at 1 Burrus-Pyle, Boatright-Springer sand discovery northwest of Knox field in C SW SE 23-4n-6w, Grady County.

The wildcat flowed 106 bbl. of oil in 4 hours on ¼-in. choke and 166 bbl. in 15 hours on ⅛-in. choke from the Boatright sand of the Springer at 10,586-99 ft.

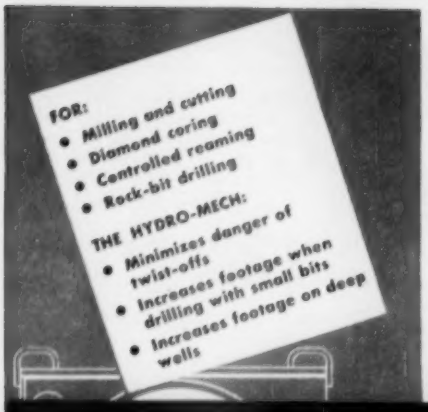
NORTH TEXAS

Young County Well Makes Heavy Flow of Oil

Young County got a big producer 7 miles west of Graham, which flowed at the rate of 1,050 bbl. a day.

J. W. Hastings et al 1-A Holcomb

EXTRA VALUE
AT NO EXTRA COST
THE EXCLUSIVE PATENTED LOCKING FEATURE . . .
of Williams new "push-button" adjustable wrench is typical of the extra value you get in Williams tools . . . and, they are so easy to get through your local distributor.
PUSH DOWN TO UNLOCK
PUSH UP TO LOCK
ALLOY "SUPERRENCHES"®
Over 30 patterns in 386 sizes from 5/16" to 3 5/16" openings.
CARBON WRENCHES
Over 30 patterns in 581 sizes with openings from 5/16" to 7 5/16".
"SUPERSOCKETS"®
1/4", 3/8", 1/2", 3/4", 1" Square Drives. Openings from 3/16" to 3 1/16".
POWER IMPACT SOCKETS
For all power and impact wrenches. Seven square drives 1/4" to 1 1/2". Hex and square openings 3/16" to 3 1/2".
TOOL HOLDERS AND SET-UP ACCESSORIES
A complete range of tool holders, lathe dogs, cutters, T-slot bolts and nuts, wedges, washers and strap clamps.
DROP-FORGED C CLAMPS
General and heavy service, Deep throat standard and spatter-resisting, Tool makers', and Machinists'.
HOIST HOOKS AND EYE BOLTS
Proof-tested Hoist Hooks, shank and eye patterns, 1/2 to 30 Ton capacities. Eye Bolts, plain and shoulder patterns, blank or threaded.
PIPE TONGS AND VISES
Tongs — 4 styles — 1/8 to 18" pipe capacities.
Vises — 2 styles — 1/8 to 8" pipe capacities.
PLUS Thumb nuts and screws, machine handles, rod ends, flange jacks, screw drivers, pliers, soft-face and ball pein hammers, punches, chisels, pullers, feeler gauges, body and fender tools, masonry bits, screw extractors, auger bits.
"THE BROADEST LINE OF ITS KIND"
WILLIAMS
INDUSTRIAL TOOLS
Write for Catalog 202
J. H. WILLIAMS & CO.
Buffalo 7, New York

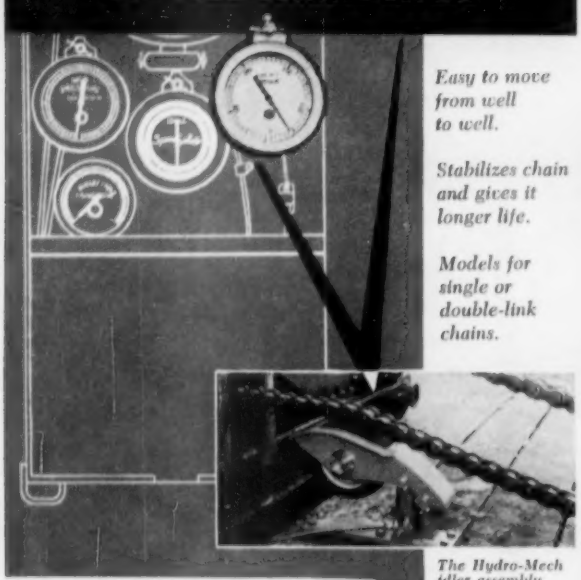


Easily installed on any chain-driven rotary.

Responds to the slightest torque changes.

Adjustable for net-torque-on-bottom.

WHY MANY OPERATORS DEMAND HYDRO-MECHS ON ALL THEIR RIGS



Easy to move from well to well.

Stabilizes chain and gives it longer life.

Models for single or double-link chains.

The Hydro-Mech idler assembly rides under the rotary chain and transmits hydraulic impulses to a gauge in the drilling-control panel or in any other convenient spot.

Torque is one of the most important variables in any drilling operation — with too little, you're wasting men and equipment; with too much, you're courting an expensive twist-off. Recognizing these pitfalls, more and more contractors and operators are demanding that their rigs be equipped with Hydro-Mech torque gauges. Compared to a $10,000 fishing job, the cost of a Hydro-Mech is certainly negligible.

Distributed through Reed, National, and other recognized supply houses.

MARTIN-DECKER CORP.
HOME OF THE WEIGHT INDICATOR — LONG BEACH, CALIFORNIA

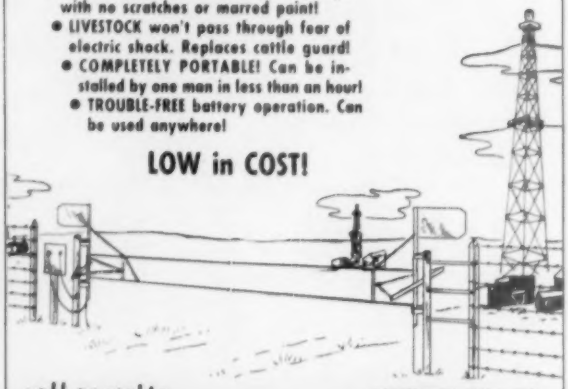
No More Costly Cattle Guards...

with the NEW

DRIVE-THRU Electric GATE

- CARS and TRUCKS drive right through with no scratches or marred paint!
- LIVESTOCK won't pass through fear of electric shock. Replaces cattle guard!
- COMPLETELY PORTABLE! Can be installed by one man in less than an hour!
- TROUBLE-FREE battery operation. Can be used anywhere!

LOW in COST!



call or write DEALERSHIPS AVAILABLE

The DRIVE-THRU GATE Co.
339 Masonic Bldg. Ph. 872
Shawnee, Okla.

Oil Loans

THE 1ST NATIONAL BANK OF SHREVEPORT
LOUISIANA'S OLDEST BANK

ROBERT F. CASHEN — Manager Petroleum Department

rated the above potential by flowing 306.41 bbl. of 41° oil in 7 hours through 24/64-in. choke. Flowing pressure on tubing was 520 psi. and gas-oil ratio was 190:1. Total depth was 4,534 ft., with pay topped at 4,508 ft. The well was drilled tight. Location is in the R. J. Fisher Survey, A-95, and is ¾ mile northeast of present production.

Coleman County Wildcat Takes Potential

Completion potential has been filed on Great Expectations Oil Co.'s 2 Mary A. Kirkpatrick, Marble Falls discovery 4 miles south of Santa Anna in Coleman County. Location is in the Wharton CSL Survey, Subdivision 9.

Operators reported top of the Marble Falls at 2,282 ft., with pay indicated to 2,328 ft., total depth. Completion gage was 105 bbl. of oil a day through 9/64-in. choke. Location of the new well is on a lease of 318 acres, with offsetting acreage held by Great Expectations on the north, and Coleman Oil & Gas Co. on the east, south and west.

Throckmorton County . . . The Texas Co. 1 Maggie Marrs has made a small pumping discovery 2 miles east of Throckmorton. Potential was 65 bbl. of oil, plus 10 bbl. of water, from pay around 4,600 ft. Location is in Bradley Garner Survey, A-292.

Jones County . . . Sunray Mid-Continent Oil Co. has opened Swastika production in northeastern Jones County, about 2 miles north of Hamlin. The strike is 1 Harriette Hill, located in Section 176, Block 1, BBB&C Survey.

Completion potential was 120 bbl. of 40° oil a day through 15/64-in. choke, from perforations at 3,570-76 ft. Total depth was 6,313 ft. Flowing tubing pressure read 175 psi. and gas-oil ratio was 1,441:1.

Location of the strike is on a 300-acre lease, with Sunray holding approximately 900 acres in the area.

EASTERN INTERIOR

ILLINOIS

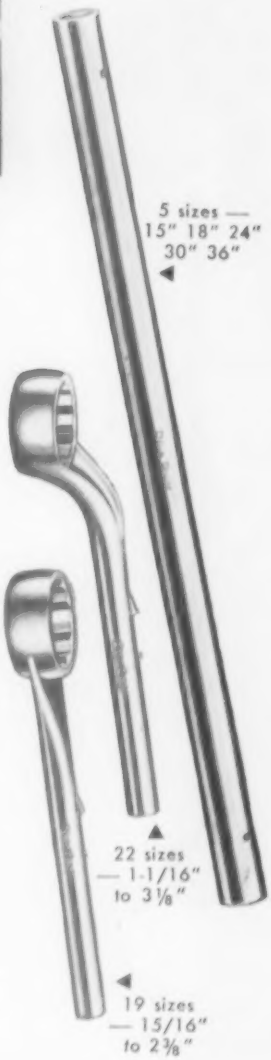
One New Oil Pool in Illinois in October

One new oil pool, Cravat West in Jefferson County, was discovered in Illinois in October. There were four extensions to pools during the month, Benton North in Franklin County, Kinmundy in Marion County, Dubois in Washington County, and Fishhook Gas in Pike County.

Drilling, which had been running

tools with MUSCLE . . .

to service big equipment



*Snap-on Blue-Point

Heavy-Duty BOXOCKET® WRENCHES

Here are the husky, powerful wrenches servicemen need on every construction machinery repair job. They're safe, dependable . . . the kind mechanics can really "lay into." And they're available in straight or offset models in a wide range of sizes.

The tightest nuts and bolts turn easily under powerful Boxocket leverage. Their trim build and long reach get these tools into location quickly and easily. When free swing is restricted, double hexagon broaching allows a short turning arc. Extension handles lock securely, can't be separated accidentally — a safety factor you and your mechanics will appreciate.

Yes sir, it's tools like *Snap-on* Boxocket wrenches that help cut downtime — put money-making machinery back to work fast. See your *Snap-on* tool dealer or write for new catalog "V" of over 4,000 *Snap-on* tools for servicing construction machinery, trucks and cars.

*Snap-on is the trademark of Snap-on Tools Corporation.

SNAP-ON TOOLS CORPORATION

8098-K 28th Avenue • Kenosha, Wisconsin

Here's the safest ratchet lever hoist ever invented!

If overloaded, "safety valve handle" will bend before any other part of hoist fails.

It's the original Coffing Safety Pull, a ratchet lever hoist with dual pawls and ratchet that keep load from slipping. Safety stops prevent spinning out of control and if overloaded, "safety valve handle" will bend before any other part of hoist fails. The ¾-ton model (illustrated) weighs but 14½ lbs.

Fifteen other models available handling up to 15 tons. Ask your favorite supply store or write for bulletin SP, Coffing Hoist Division, Duff-Norton Company, 818 Walter St., Danville, Ill.

The exclusive, cadmium plated *Coffing Safety Hook* with spring actuated locking latch designed to shed, not snag, on wires or other objects is available for the ¾-ton, 1½-ton and 3-ton models at slightly additional cost.

COFFING HOIST

Division of DUFF-NORTON COMPANY

ahead of last year, has slowed up a little. The number of wells completed during the first 10 months of 1955 and 1956 is about the same. In October there were 293 wells drilled, including 115 oil wells and 11 gas wells.

Daily production continues at about 235,000 bbl. The estimated production for October is 7,293,000 bbl. Production for the first 10 months of 1956 is about 2,000,000 bbl. more than for the same period in 1955.

The Coles-Douglas County area is still one of the most active spots in the state. Drilling in the Cooks Mills Consolidated pool in October resulted in completion of 10 oil wells and 3 dry holes. Bourbon pool had 11 producing wells and 2 dry holes, and Chesterville had 2 oil wells.

Drilling in Germantown East pool in Clinton County had slowed down. Three oil wells were completed in October; five more were drilling.

In Wabash County, development of the Gards Point pool, which ended several years ago, was begun again this fall. Five oil wells were completed in October and 4 were drilling at the end of the month.

Skiles Completes Illinois Lime Producer

The 1 Henderson in Skiles' Geff West block near the town of Geff, Wayne County, Illinois, flowed 720 bbl. per day when drilled into the Rosiclaire formation. A deeper Mc-Closky pay at 3,300 ft. also gave up oil in commercial quantities. It is expected that the well will yield 250 bbl. per day or more, when put on pump. Skiles has room for 20 or more offset wells on this property.

Thirty-one wildcat wells remain to be drilled in 1956 by Skiles on widely separated blocks in the Illinois-Indiana basin.

APPALACHIAN

OHIO

Clinton Oil & Gas Co. moved 1,000 ft. west of the field in Hopewell Township, Licking County, and brought in a nice well on 4 John Spencer, Lot 3. Clinton was found at 2,995-3,029 ft. and gaged 300 bbl. in 24 hours after fracture. Two development wells in the field will make good producers: Oil Development 6 Dodson, Section 20, made 197 bbl. from sand at 3,171-3,210 ft. and Oxford Oil Co. 8 Kreager, Lot 11, made 232 bbl. from sand at 3,090-3,137 ft., both after fracture.

● The new gas pool in Knox Township, Holmes County, was further extended by Ohio Fuel Co. 1 E. C.

Bevington, Section 13. Clinton sand was logged at 3,011-33 ft. and gaged 1,230,000 cu. ft. after fracture.

EASTERN KENTUCKY

In Wolfe County near the town of Bethany and close to the Breathitt County line, United Carbon Co. has drilled to a depth of 3,800 ft. at its rank wildcat test 1 Rose. Several gas showings have been had in the Corniferous lime section and also the deeper Ordovician St. Peter-Knox horizon. Operator is currently testing.

PENNSYLVANIA

In Young Township, Indiana County, Southwest Pennsylvania, T. W. Phillips Gas & Oil Co., 3 Fee, (Neal surface) reached the Tully lime at 6,850 ft., and drilling at 7,415 ft.

- New York State Natural Gas Corp., has started another new Florence Bodin N-514 and is at a depth of 163 ft.
- In Armstrong Township, Peoples Natural Gas Co. 4107 E. Carney, is drilling at 6,435 ft.

WEST VIRGINIA

Sherman district, Hampshire County, West Virginia, Transcontinental Production Co. 1-4 S. T. Haines, elevation 1,342 ft., which reached the Oriskany sand at 5,853 ft., and had a show of gas is now shut down at 6,208 ft., to fracture.

- Plymouth district, Mercer County, Bluefield Gas Co. 1-100 Dee & Lola Bailey, is drilling at 608 ft.
- Morgan district, Monongalia County, Plymouth Oil Co. 1 Myrtle Pixler, is shut down at 1,000 ft., to move in spudder.

HUGOTON EMBAYMENT

OKLAHOMA PANHANDLE

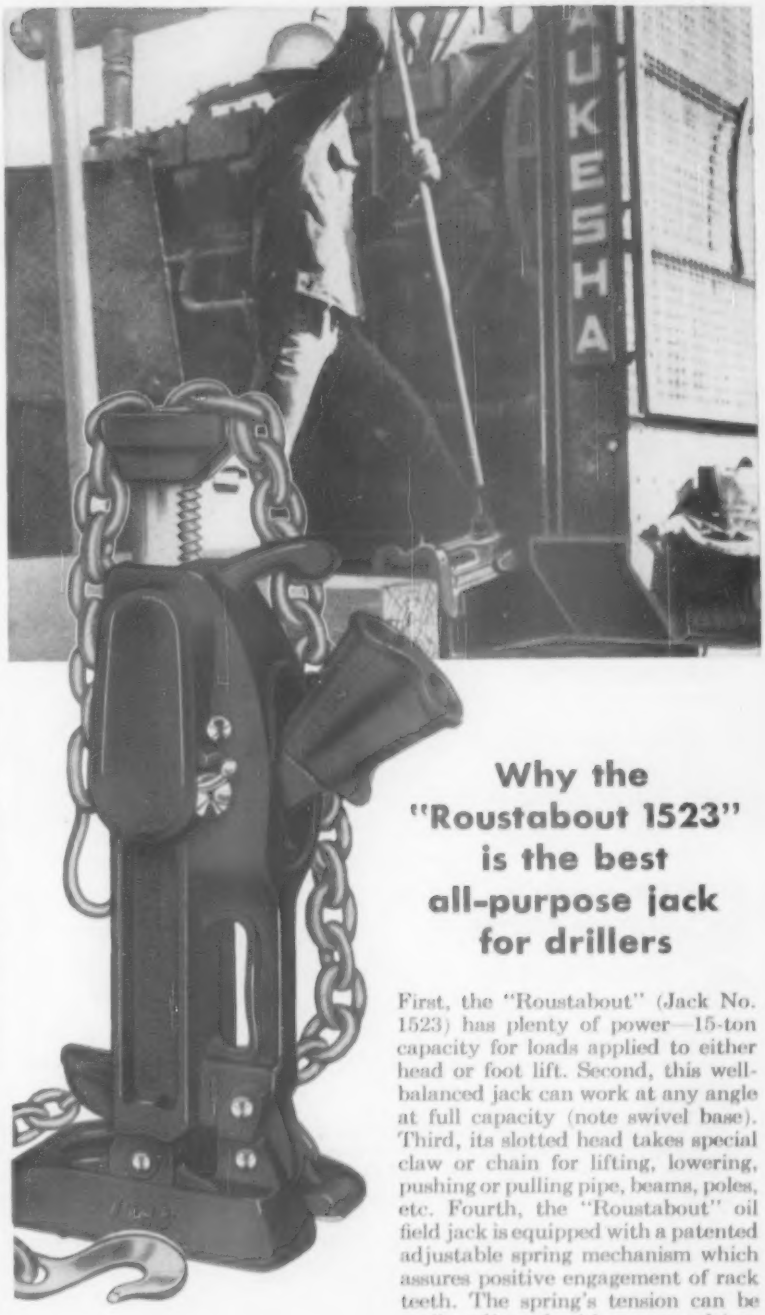
Marmaton Field Opened In Beaver County

Beaver County has a new Marmaton lime-Pennsylvanian pool. The discovery well, located in western Beaver's SW SW NE 2-2n-20eCM area, is Union Oil Co. of California 1 George.

Recovery on a test at 5,920-50 ft. was 2,200 ft. of oil and 600 ft. salt water. Drilling continues.

Toronto Pay Opened Inside Hugoton Field

A Toronto gas discovery was reported inside Hugoton gas field in Texas County. The discovery well is Panhandle Eastern Pipe Line Co. 1 Wilson,



You can get the "Roustabout 1523" at your favorite supply store!

Why the "Roustabout 1523" is the best all-purpose jack for drillers

First, the "Roustabout" (Jack No. 1523) has plenty of power—15-ton capacity for loads applied to either head or foot lift. Second, this well-balanced jack can work at any angle at full capacity (note swivel base). Third, its slotted head takes special claw or chain for lifting, lowering, pushing or pulling pipe, beams, poles, etc. Fourth, the "Roustabout" oil field jack is equipped with a patented adjustable spring mechanism which assures positive engagement of rack teeth. The spring's tension can be easily adjusted with a screw driver without removing any part of the jack. Send for Oil Field Jack Bulletin Ad-19B to the Duff-Norton Company, P. O. Box 1889, Pittsburgh 30, Pa.

DUFF-NORTON *Jacks*

"Giving Industry A Lift Since 1883"

W & T Sensitive SURVEYING ALTIMETERS

DURABLE

SELF-BALANCING

CUSTOM CALIBRATED

ACCURACY 0.1%

STANDARD RANGES

Minus 1000 to 3000 feet
Minus 1000 to 6000 feet
Minus 1000 to 15000 feet
Special Ranges Available

Write for additional information

WALLACE & TIERNAN INCORPORATED

25 MAIN STREET, BELLEVILLE 9, NEW JERSEY

In Canada, Wallace & Tiernan, Ltd. — Toronto

A-118

E. R. P. CATHODIC PROTECTION
...INDIVIDUALLY DESIGNED FOR EACH APPLICATION

to prevent corrosion of buried or submerged metal structures

Write for Bulletin E-37

E-37

ELECTRO RUST-PROOFING CORPORATION

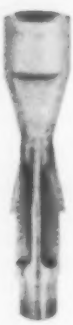
30 MAIN STREET, BELLEVILLE 9, N. J.

GREATEST ADVANCEMENT IN SWAB HISTORY!

The Oil States Swab is the most advanced swab on the market having been developed and perfected after years of research, painstaking work and engineering skill. It's acceptance has been overwhelming.

HERE ARE THE FEATURES YOU WANTED

- ★ Fewer cups to handle ANY job
- ★ NO Servicing
- ★ Responds to lightest loads
- ★ Swab can be EASILY UNLOADED at any time
- ★ Valve action from base of cup
- ★ Perfect for swabbing following frac jobs
- ★ Only 6 parts Required to Assemble a 2-Cup Swab



SOLD THROUGH SUPPLY STORES EVERYWHERE

(CUTAWAY)

Oil States

OIL STATES RUBBER CO.
ARLINGTON, TEXAS

C W½ SE 23-4n-13eCM, a deep test inside the Permian gas area.

On drill-stem test at 4,202-76 ft. the well flowed 3,250 M.c.f. per day. Drilling continues.

TEXAS PANHANDLE

Two oilers were completed by Sunray Mid-Continent Oil Co. in Hansford County. The 6 Rex Sanders flowed 285 bbl. of oil through a 16/64-in. choke with a tubing pressure of 680 psi. and a gas-oil ratio of 4,648:1. The well was completed in the Hepler zone after perforations at 6,270-76 ft. Total depth of the hole was 6,710 ft.

• Also in Hansford County's North Hansford (Cherokee) field, Sunray swabbed 315 bbl. of oil in 24 hours at its 9 Sanders. Perforations were made at 6,305-15 ft. in the Hepler zone. The well is located 330 ft. from the north line and 990 ft. from the east line of Section 94, Block 45, H&TC Railroad Survey. The 9 Sanders is on a 640-acre lease. The company holds an additional 760 acres adjoining.

NORTHWEST OKLAHOMA

Dual Producer Completed in Harper

Sunray Mid-Continent Oil Co. has completed 1 A. Bonham as a dual-producer in the South and Southeast Laverne gas field in Harper County. The well, Sunray's seventh gas well in the field, is a 1-mile stepout of the company's 1 H. K. Hill, a wildcat which was completed earlier this year.

The new gasser flowed at the rate of 5,020,000 cu. ft. of gas a day through a 32/64-in. choke after perforations from 4,288-4,308 ft. in the Hoover zone, with a tubing pressure of 800 psi.; and at the rate of 5,210,000 cu. ft. of gas a day through a 32/64-in. choke following perforations from 7,174-86 and 7,204-16 ft. in the Morrow zone, with tubing pressure of 975 psi. The well is located at the NE NE SW 31-26n-25w.

WEST TEXAS

WEST TEXAS

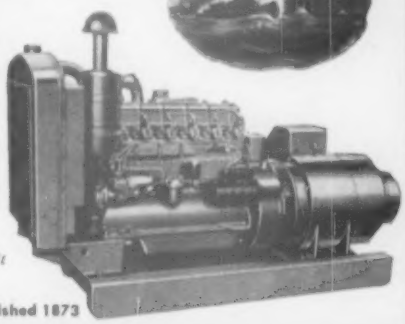
Winkler County Ellenburger Strike Is Completed

Completion has been made at Superior Oil Co. 1-A Walton, 21-B3-PSL, 3 miles northeast of Kermit. Flowing potential from the Ellenburger was 243 bbl. of 43° oil a day through 19/64-in. choke from perforations at 10,632-36 and 10,641-50 ft.

The well has made flow of high-

KOHLER Electric Plants
for heavy-duty independent power
Sole supply and stand-by

Diesel models for offshore service include sizes 10 to 35 KW for rig lights, floodlights, power tools; 10 KW models are used for quarter boat lights and galley equipment. Gasoline or gas operated liquid cooled models from 2 to 35 KW for all other rigs. Air cooled portable plants from 500 to 5000 watts for seismograph equipment, geophysical survey trucks. Also automatic stand-by plants for refineries. Write for folder R-11.



Model 35R561, 35 KW, 115/230 volt AC. Diesel. Remote starting.

Kohler Co., Kohler, Wisconsin • Established 1873

KOHLER OF KOHLER
PLUMBING FIXTURES • HEATING EQUIPMENT • ELECTRIC PLANTS
AIR-COOLED ENGINES • PRECISION CONTROLS

"According to Hoil"
H₂OIL GAS GARD®
FOR USE ON • PUMPING UNITS • TREATERS • DRILLING RIGS • COMPRESSORS • BUILDINGS

The H₂Oil Gas Gard is a safety device carefully designed and engineered to assure 100% protection against the numerous hazards involved where wet gas installations prevail. Its diversified applications make this unit a "MUST" where safety and economy are the prime objectives. Positive shut-off. 4" x 30" x 125#—$54.50, F.O.B. Tulsa, Okla. Available in any size and pressure.

H₂OIL "GAGE IT"

- NO BATTERIES
- ACCURATE MEASUREMENT
- EASY TO READ
- SIMPLE TO OPERATE
- NOTHING TO WEAR OUT
- A NECESSITY FOR ALL PERSONS WHO MEASURE OIL
- ADAPTABLE TO ANY GAGE LINE

U. S. Pat. 2,710,666 Canadian Pat. 523,467

The H₂Oil "Gage-it" retails for $39.50 F.O.B. Tulsa, Okla. Approximate Packaged Weight Two Lbs. Standard Length Gage Tapes Available On Request.

The "Gage-it" is a device for determining the Water-Oil interface in a stock tank when attached to any standard type gauge line. It will also determine the Water-B.S. interface provided the B.S. carries enough water that a current may be established from the shell of the tank to the gauge plumb bob.

H₂OIL ENGINEERING CORP.
1601 South Yale TULSA 16, OKLA. P. O. Box 5094, Donaldson Station

gravity oil from the Devonian and an attempt will be made for dual completion.

Devonian oiler in Halley field . . . Sunray Mid-Continent Oil Co. 6 Hill, 22-11-PSL, on the south flank of Halley field, 9 miles southeast of Wink, has been completed as a Devonian well. Some maps show a Devonian completion ¾ mile to the west, in the same section.

Sunray's well flowed 413 bbl. of oil a day through ¼-in. choke, from perforations at 9,884-9,900 ft. Tubing pressure was 2,100 psi. and gas-oil ratio was 2,404:1.

Andrews County . . . The Bakke field in Andrews County gained its second Ellenburger producer and had prospects of a third well.

W. E. Bakke 2-A Grady, 22-A44-PSL, made a flowing potential of 726.5 bbl. of oil a day, based on a 12-hour flow through ¼-in. choke. Ellenburger perforations were at 12,381-12,421 ft. Tubing pressure was 1,050 psi.

The well was a dual producer, having completed last week from the Devonian, for 731 bbl. of oil a day through ¼-in. choke, from pay at 10,530-46 ft. Location is ⅜ mile northeast of the field opener.

The field's third prospect is Woodley Petroleum Co. 1-G Parker, 27-A44-PSL, which is a south offset to the discovery. On test of the Devonian at 10,458-10,550 ft., recovery was water blanket plus 2,400 ft. of oil. Flowing pressure ranged to 1,430 psi. Projected depth is 12,500 ft., to test the Ellenburger.

Immediate Shipment All Over The World!

a bitmaker's bit . . .

Williams HoleMaker ROCK BITS

For air or water—a 3-cone rock bit made of the highest Nickel Moly steel in a full range of sizes from 3¼" to 7⅞" in both shale and hard rock types for slim hole and shot hole drilling.

Consistency and finest quality guaranteed through heat treating in newest automatic furnaces. All bearing surfaces are ground finished. Ball bearings and roller bearings throughout bearing assembly make the anti-friction Hole-Maker the freest rolling bit.

Williams HoleMaker ROCK BITS

. . . made better to drill faster.

MANUFACTURED BY OIL TOOL MANUFACTURING CO.

TONKAWA, OKLAHOMA

P. O. Box 712

Phones 143 and 138

BOOK REVIEW

PETROLEUM REVIEW OF WARD COUNTY, TEXAS, by Robert L. Phifer. Published by Phifer Petroleum Publications, P. O. Box 20,024, Houston, $10.

This is the sixth volume of a series on oil-producing counties of West Texas; previous volumes covered Andrews, Ector, Crane, Gaines, Yoakum, and Terry counties.

Ward County has been producing oil since 1928 when Shipley Oil Corp. completed a Queen sand producer as the discovery well of Shipley field. This new volume presents detailed statistics on every phase of operation in the 42 fields in the county. It is complete with type logs, structure maps, and production tables.

According to Phifer, Shipley field has produced, through 1955, a total of 10,582,733 bbl. of oil and still produces 1,100 bbl. per day from 180 wells.

The most productive field in Ward County has been North Ward-Estes, with a cumulative production total of 86,345,734 bbl. up to January 1 of this year. It was discovered in 1929 and was the second field for the county. It is the county's largest field in areal extent, having 1,081 wells on production. There are 11 water-flood projects in operation in this large field.

GREAT LAKES

MICHIGAN

New completion along the southeast side of the Reynolds Dundee-Reed City zone oil pool, Montcalm County, this week, appeared to point the way to additional expansion of this pool to the southeast.

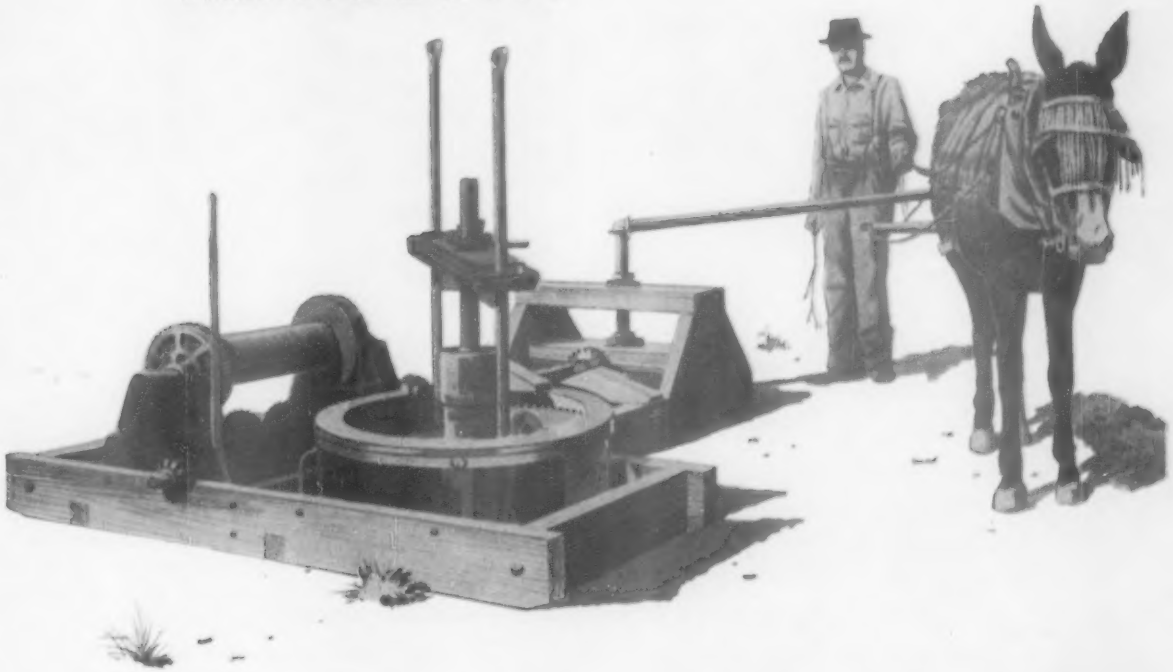
New producer, Osceola Refining Co. 2 Buck, SE SE NE 18-12n-9w, Winfield Township, the most southeasterly well completed in the pool, logged a typical oil pay zone and was structurally high enough on this pay to indicate that offsets to the east should be in the money.

Dundee top at 2 Buck was logged 3,235 ft. Pay showed between 3,336 ft. and the total depth, 3,338 ft. Well filled and was flowing within 2⅓ hours after pay was tapped. On a 30-minute flow test, only measured gage before tubing was run, well produced 15 bbl. Operators estimated that well would easily produce its 75-bbl. per day allowable rate natural.

The bulk of the undrilled acreage that appeared to be proved up by this new producer is under lease to Swan-King Oil Co. and associates, discoverer and largest producer in the pool.

The Reynolds pool moved to a top ranking position among Michigan oil

IMPROVEMENTS IN DRILLING METHODS . . .



. . . BRING ABOUT MAJOR EQUIPMENT CHANGES

The result is tremendous savings in drilling costs to the operator.

And that's just the start! Equipment now being tested—now on drafting boards—will result in faster penetration rates—lower moving and maintenance cost.

But the spark of drilling progress is a healthy contracting industry *ready with the capital necessary to put these developments into widespread use.*

This capital only comes from profits.
IT'S WORTH A LOT TO THE PRODUCER FOR THE CONTRACTOR TO MAKE A REASONABLE PROFIT.

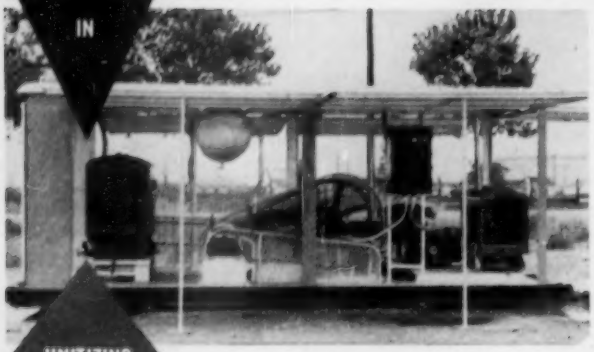
UNIT RIG & EQUIPMENT COMPANY / TULSA, OKLAHOMA

REPRINTS AVAILABLE ON REQUEST

UNIT RIG

"SUPPOSE YOU OWNED A DRILLING RIG. . ." NO. SIX IN A SERIES

S&R SPECIALIZES IN



UNITIZING

FABRICATING

REPAIRING

MACHINING

RIG-UP FOR EXPORT

Since S&R is distributor for all major manufacturers of power transmission equipment, pumps, generators, engines, compressors, etc.—all component parts can be unitized quickly and economically. The oilfield utility unit pictured above is but one of many oil country items unitized by S&R.

Combine this with S&R's setup for complete fabrication and you have a one-source supply for tool, change and utility houses, for portable steel mud pits, telescoping pole masts, conveyors, pump suction strainers, equipment repair and rig-up for export.

Whenever you have a special job—or a problem that needs a solution—bring it to S&R.

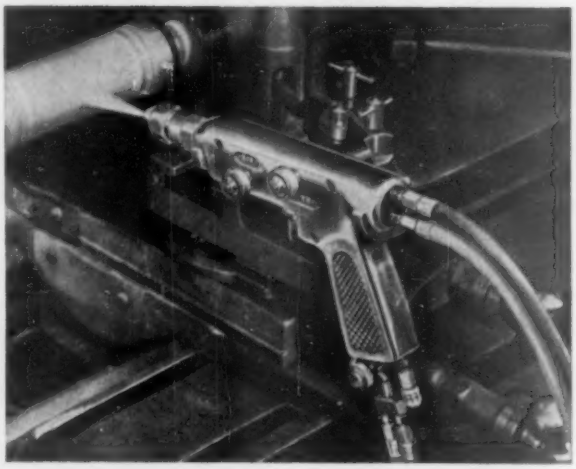
S & R TOOL & SUPPLY CO.

P. O. Box 1755 • 155 McCarty

Houston 1, Texas

Export: 45 Rockefeller Plaza, New York 20, N. Y.

STOP CORROSION

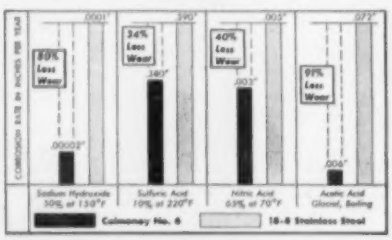


with Colmonoy Spraywelding

The superior corrosion resistance of Colmonoy No. 6 alloy makes it the ideal hard-facing material for use on surfaces undergoing metal-to-metal wear under corrosive conditions, such as pump and valve parts.

The Colmonoy Spraywelder puts No. 6 on fast, in powder form. It makes smooth overlays within .010" of desired size, requiring a minimum of finishing. Sprayweld overlays are solid and welded to the base metal.

The corrosion of vital process equipment parts becomes needless waste when the wear resistant qualities of Colmonoy No. 6 are combined with the economy and ease of the Spraywelder.



This table shows the comparative resistance to corrosion of Colmonoy No. 6 and 18-8 stainless steel. No. 6 is resistant to almost all caustics and acids. Ask for Engineering Data Sheet No. 3.

WRITE RIGHT NOW

For the Colmonoy Spraywelder Catalog and Hard-Facing Manual No. 79

HARD-FACING & BRAZING ALLOYS

WALL COLMONOY CORP.

19345 JOHN R STREET · DETROIT 3, MICHIGAN

BIRMINGHAM · BUFFALO · CHICAGO · HOUSTON · LOS ANGELES
MORRISVILLE, PA. · NEW YORK · PITTSBURGH · MONTREAL · GREAT BRITAIN

pools in September. During that month the 26 producible wells in the pool then produced a total of 50,186 bbl., to become the third most prolific pool in the state. It was surpassed only by the Coldwater field, Isabella County, which produced 69,390 bbl. from 64 wells, and the Deep River pool, Arenac County, which produced 61,931 bbl. from 71 wells.

Both the Coldwater and Arenac-Deep River pools are declining fields.

WESTERN CANADA

SASKATCHEWAN

Seventy-Foot Pay Opened in Charles

Gridoil Freehold Leases, Ltd., has been assured of light gravity oil production at another wildcat venture in southeastern sector of Saskatchewan after opening up a gross pay thickness of 70 ft. in the Charles sector of the Mississippian zone. The well is located 3 miles west of the main development sector of Weyburn oil field and during a series of tests in the discovery horizon, oil flowed to the surface on one while the other two tests also gave up indications of oil porosity.

This wellsite, Gridoil 12-26 Weyburn, on LSD 12, 26-6 14w2, lies within the field limits of Weyburn oil field as outlined by the Saskatchewan Department of Mineral Resources, but is actually 3 miles from the nearest field producer.

Discovery was indicated during the first test, run around the 4,500-ft. mark while the best test, the one that flowed crude, was bottomed at 4,553 ft. and as well as flowing the pipe recovery was 4,553 ft. oil. Third drill-stem test and last reported from the strike gave up: 1,860 ft. of gassy oil-cut mud, grading to mud-cut oil; 360 ft. of gassy slightly mud-cut oil; 1,530 ft. of gassified oil and 275 ft. of oil and mud-cut salt water.

The operator indicated that coring and testing operations will be continued and that the well is to be taken down to test the Mission Canyon horizon as well.

ALBERTA

Wabamun Oil Found At High River

Texaco Exploration Co. has discovered light gravity crude oil in the Wabamun zone of the Devonian formation at its exploratory test in the High River area of southern Alberta, 30 miles south of Calgary's city limits, and 14 miles southwest of the Okotoks gas field. During a drill-stem test in the formation the well flowed oil to surface and pipe recovery showed 3,000 ft. of clean oil.

This well, Texaco-C&E A-1-25 High River, on LSD 1, 25-18-30w4, lies on acreage which it acquired under an agreement with the Calgary & Edmonton Corporation, 9½ miles east of oil production in the famous Turner Valley oil field.

This well also gave some oil encouragement in the Mississippian during earlier drill-stem tests, around the 8,300-ft. mark, while the present discovery was made between 9,622 and 9,646 ft. There was also a good gas flow during the Wabamun test, reaching a flow rate of 1,250,000 cu. ft. daily.

Colorado Gets Gas At Normandville Well

Colorado Oil & Gas, Ltd., operator of a development and exploration project in the Normandville district of northwestern Alberta reported the discovery of gas in indicated commercial volume at its 4-15 Normandville driller. This current test, being drilled

The only fuel and oil supplement engineered for heavy-duty engines

Here are the facts!

- ✓ *All fuels and oils will "break-down" under heat and pressure, forming carbon, gum, varnish and lacquer.*
- ✓ *These deposits are the cause of burned valves, stuck rings, premature wear, and wasted fuel and oil.*
- ✓ *Engine acids, formed during combustion literally eat the metal surfaces of rings, pistons, cylinder walls, and bearings—reduce the lubricating value of the oil.*

Guard Against These Conditions with L-X

L-X added to the fuel and oil, penetrates the pores of the metal — then gently cleans from within. Harmful deposits are removed from valves and rings — peak operating efficiency is restored — engines deliver greater power — have more pep. The constantly moving film of L-X shields against the ravages of acid wear — reduces frictional wear, provides supplemental lubrication to "dry" fuels. Whether your engines run on gasoline, diesel fuel, LPG or natural gas — they need the protection only L-X can give.

Get Results — Not Promises

AVAILABLE THROUGH MOST LOCAL SUPPLY STORES, OR WRITE, WIRE OR CALL FORT WORTH OFFICE DIRECT

LUBRICATION ENGINEERS, INC.
FORT WORTH, TEXAS
INDUSTRIAL LUBRICANTS AND OIL FIELD SPECIALTIES

on LSD 4, 15-79-22w5, ¼ mile east of the Imperial 1 Normandville Devonian oil discovery well, as well as recording gas flows of up to 5,400 M.c.f. daily on Permo-Penn drill-stem tests also gave very encouraging recoveries of light gravity crude oil from the same formation. Further testing of the zone will be required to determine its potential, but the oil shows were significant and will add further incentive for exploration in this already interesting area, which lies 20 miles south of the town of Peace River and 45 miles north of the Sturgeon Lake oil producing area.

The drilling program at Normandville began in earnest after the successful re-completion of Imperial's 1 Nomandville suspended D3 oil discovery well. This test is the second follow-up to that strike and in addition the operator is carrying out gas exploration and development activity in the general area. Colorado's partners in the well and spread of approximately 140,000 acres in the general area, include: Okalta Oils, Ltd., Canada Oil Lands, Calalta Petroleums, Ltd., Plains Petroleums, Ltd., and Imperial Oil, Ltd.

The Permo-Penn was encountered around the 3,050-ft. mark and the three tests run in the discovery formation all gave up gas with the latter two indicating the presence of some oil. The last test also gave up some salt water.

This well is scheduled to test the Devonian formation and crew resumed drilling operations after the completion of the third test which was bottomed at 3,090 ft.

PACIFIC COAST

CALIFORNIA

GP Hits at Devils Den

General Petroleum Corp. gave the busy Devils Den field its first Eocene pool production with completion of 31-3 Alferitz as a new deeper pool discovery. The wildcat is located on the north flank of the Alferitz anticline in NE SW 3-25s-18e. Originally drilled to 4,932 ft. it was plugged back to 4,530 ft. and completed flowing through a 60 mesh liner in the interval 4,245-4,529 ft. Initial production was 259 bbl. daily of 47.5°-gravity crude. Other production in the field is from Oligocene or Miocene formations.

Union Misses in San Mateo

Union Oil Co. missed on an extension test ¾ mile northwest of its Oil Creek discovery in San Mateo County. Union quit the well after running a Johnson formation test of the interval 3,460-3,605 ft. With no cushion and a 1-in. choke, the test recovered 775 ft. of gas-cut mud in a 1-hour test.

Oakridge Fault Activity

Activity along the 30-mile long Oakridge fault in Ventura County was highlighted by one big completion, an abandonment and the testing of the first offset to a recent discovery along the fault.

Shell Oil Co. dually completed 5 Edwards under the fault at Saticoy field for 633 bbl. daily from a Pliocene interval at 6,346-6,820 ft. and 7,272-7,459 ft. This well is located in SW SW 29-3n-21w.

Union Oil Co. abandoned a 12,004 ft. wildcat in the Balcom Canyon region 5 miles east of the booming Bridge area-South Mountain field after running electric logs, sidewall sampler and dipmeter.

Meanwhile, Union was testing 2 Berylwood, the first offset to its recent Pliocene discovery in the old Bardsdale field same 8 miles east of the Bridge area. This first offset on the northwest flank of the Bardsdale field was 5,719 ft. Prior to Union's discovery of Pliocene production with 1 Berylwood under the Oakridge fault all Bardsdale crude had come from Oligocene or Eocene formations.

To give you the best service

In the Bridge area drilling was going ahead on nine wells. Seven were joint ventures of The Texas Co. and Union Oil Co. with Texaco as operator. The other two were tests by Union Oil Co. on the northeast edge of the Bridge area and G. R. Nance's test ¾ mile south of the Bridge area. Shell had three rigs active in the Saticoy in play also associated with the Oakridge fault.

ROCKY MOUNTAIN

COLORADO

Permian Discovery Indicated in Weld

A new Permian producing area may be in prospect for the Denver basin. The California Co. 1 Brunner, C SW SW 26-7n-67w, Weld County, 4½ miles south of Black Hollow-Permian field, recovered 692 ft. of clean oil on a drill-stem test in the Lyons at 8,960-90 ft.

Only two fields in the Denver basin have successful Permian oil development. Black Hollow field was opened to Lyons sand production 3 years ago, and to date there have been 17 producing wells completed. The field is still developing and is defined only on the south end. Last year The California Co. got Permian production at Pierce field in Weld County. This field has three Lyons sand producers.

UTAH

North Desert Creek Adds Confirmation

The confirmation well and northeast offset to North Desert Creek in San Juan County, Paradox basin, flowed oil at the rate of 1,402 bbl. per day. Superior Oil Co. 1 Navajo-B, N½ SW SW 7-41s-24e, is the confirmation well to Shell Oil Co.'s North Desert Creek Paradox-Pennsylvanian discovery of last September which flowed 1,440 bbl. per day on 48/64-in. choke.

North Limit Hinted At Aneth Test

There may be a northern limit to Aneth field in San Juan County in the making as a result of The Texas Co.'s 3 Navajo-E, C NW SE 9-40s-21e, 1 mile northeast of the western end of the main producing area. This wildcat made 80 per cent salt water on test of the Paradox. Tests are continuing, but the well may be the first drilled in the Aneth campaign to hint the field's pssible north limits.

Better news came from the south of Aneth. The Texas Co.'s 4 Navajo-C well in SW SE SW 26-40s-24e flowed 642 bbl. per day on ½-in. choke from the upper Hermosa at 5,692-5,750 ft. This is the first well in the central, main producing area of Aneth to produce from the Hermosa. Wells at both ends of the trend have completed in the upper Hermosa, however.

WYOMING

Wildcats Pick Up in Green River Basin

New exploration is seen for southwestern Wyoming's Green River basin with four wildcats announced, three for the far west side of the basin, and one north of Baxter basin on the Twin Rocks Unit.

The California Co. will drill 1 Unit in SW NE SW 14-26n-113w, Birch Creek area, Sublette County, aiming for the Nugget at 10,000 ft. This wildcat is 1 mile east of shallow North LaBarge field.

Vaughan B. Connelly will drill the A-1-C33, C NW SW 33-27n-113w, 2 miles southeast of Hogsback field, a Frontier gas area, and 1 mile west of LaBarge field. This one will test to the Frontier at 7,500 ft.

John W. Kemmerer will deepen 2 East LaBarge Unit, 5 miles east of LaBarge in NW NW NE 33-27n-112w. The well was originally drilled to 3,444

...under all conditions

CENTRALIZER PERFORMANCE

The painstakingly engineered design of Larkin Centralizers has provided the oil industry with a product that exceeds every known requirement for centralizer performance . . . performance that has been verified and certified by an unbiased testing laboratory.

And the field results . . . now proved again in hundreds of applications . . . have shown that Larkin Centralizers will meet any demand:
• Convenience of installation • Ease of starting • Maximum centering force • Minimum permanent set • Economy

Larkin offers a complete selection of Casing Centralizers, in Long or Short Lok-On or Slip-On Types with five ranges for maximum efficiency. Specify Larkin "through your supply store." You'll get the best service under all conditions.

LARKIN PACKER COMPANY, INC.
WAXAHACHIE, TEXAS

LARKIN
...Through Your Supply Store

LARKIN LEADERSHIP HAS BEEN EARNED BY YEARS OF DEPENDABLE PERFORMANCE

For The Holidays...Or Every Day... It Pays To Travel By Car:

To get the most out of holiday family reunions, go by car. Avoid congested stations, trains, and planes . . . travel in leisure and comfort. And take the route where the scenery is loveliest.

And remember—the more you drive on those holiday trips . . . the more you use your car all through the year—the less it costs per mile. That's because major expenses on your car . . . like depreciation and insurance . . . are *fixed* costs. They stay the same, even if you drive ten times as much as you've *been* driving. So every mile costs *less* as you drive!

Also, it costs almost the same to take five as to take one . . . another giant saving when you go by car.

SKELLY OIL COMPANY

Marketing Headquarters: Kansas City, Missouri
Executive Headquarters: Tulsa, Oklahoma

Division Offices: Kansas City • St. Paul • Omaha • Cedar Rapids • Chicago • Tulsa • Wichita • Denver • Dallas

ft., and will now be taken down to the Frontier at 8,150 ft.

In Sweetwater County's Twin Rocks Unit, SE SW SW 21-21n-103w, Carter Oil Co. will drill the 2 Twin Rocks Unit. This well is 9 miles north of Baxter Basin field, planned for the Frontier at 4,600 ft., and is 1 mile north of the 1 Unit Frontier discovery in C SW SW 29-21n-103w, a gas discovery of earlier this year.

NORTH DAKOTA

Amerada Sets Casing at Deep Beaver Lodge Well

Amerada Petroleum Corp. set casing at 11,187 ft. at 1 Iverson-Nelson, a deep hole in Beaver Lodge field, NW SE NE 2-155n-96w, Williams County, and is waiting for cement.

The operator found good oil shows in cores from 10,279-10,483 ft. Last top reported was the Winnipegosis at 11,134 ft. A Dawson Bay core at 10,710-68 ft. recovered 58 ft. of lime and dolomite with odor and fluorescence locally.

Rank Wildcat Drilling In Eddy County

Wetch, Zachmeier and Disney are drilling at 2,580 ft. in the Ordovician-Red River at 1 Ceblaskey in C SE SE 9-148n-62w, Eddy County, in an area of no previous drilling. Location is 5 miles northeast of McHenry.

ARK-LA-TEX

ARKANSAS

Confirmation Completed To Winchester Field

The confirmation well to Winchester field, 1½ miles southeast of New London, Union County, was completed for 90 bbl. of oil per day on pump. The well is Olin Oil & Gas Corp. F-2 Olin Fee, C SE NE SW 2-18s-12w. Perforations are at 2,631-35 ft. The confirmation strike is about ¼ mile west-southwest of the discovery.

Tokio Discovery Takes Gage in Lafayette

Exploration Drilling, Inc. gaged its new Tokio oil discovery 2¼ miles north of Stamps, Lafayette County, pumping 40 bbl. of 15°-gravity oil per day from perforations at 2,295-2,301 ft. The discovery well is the 1 F. M. Shewmake estate, SW NE NW 32-15s-23w, 1⅛ miles north of North Stamps field.

EAST TEXAS

DST Details Released on Henderson County Wildcat

Humble Oil & Refining Co. 1 South Chandler Unit, Henderson County, 5 miles south of Chandler, has reported a flow of oil while drill-stem testing the Bacon limestone.

Operators had a drilling break at 9,376-80 ft., tentatively called the Bacon lime, and ran a test between 9,304-9,411 ft., using ¼-in. top and bottom chokes. Oil reached the surface in 1 hour and 50 minutes but the rate of flow was not disclosed. Bottom-hole flowing pressure was 2,895 psi., and 60-minute shut-in pressure reached 6,000 psi. Oil was 46°, and recovery in the stem was oil, with no water.

Wood County . . . Sub-Clarksville oil shows were reported for a Wood County wildcat 2½ miles northwest of the town of Golden. The Belcher Trust Elsie Mae 1 Bowman, G. Hallmark Survey, A-280, indicated sand with oil shows when MicroLog was run, but mechanical troubles halted two drill-stem tests at 4,500-20 ft. Drilling ahead, the well entered the Woodbine around 4,990 ft.

British-American Oil Producing Co.'s

There's a **JENSEN JACK** made for your well!

No matter where your well is located . . . or how deep or shallow . . . there's a JENSEN JACK engineered to fit your pumping needs—exactly!

There are 13 different sizes and 24 different gear ratios. One man can change from single to double reduction, or from double to single, quickly—right in the field. Counterbalancing is also a quick, one-man operation.

To get the most profit from your well, install the JENSEN JACK designed to do the pumping job required by your well. Write us or see your JENSEN Dealer.

JENSEN JACKS

JENSEN BROS. MFG. CO., INC.
Coffeyville, Kansas, U.S.A.
Export Office:
25 Broad Street, New York City

1-B Bessie Weisenhunt, the firm's confirmation attempt to its discovery on Hainesville salt dome, was drilling below 5,357 ft. in shale and chalk. Top of the chalk was picked at 5,293 ft.

SOUTH TEXAS

TEXAS GULF COAST

Dual Completion Gives Woodsboro Another Pay

One of the two sands in which Southwestern Oil & Refining Co. has completed its 2 Boenig at Woodsboro, in Refugio County, gives this multiple-pay field another productive zone, designated as the Boenig sand.

It is the deeper of the two pays. It is perforated at 5,883-89 ft., and produced at the rate of 132 bbl. of 43.6°-gravity oil per day through ⅞-in. choke with gas-oil ratio of 455 cu. ft. per barrel, and pressure of 375 psi.

The upper pay, the FT-8 sand, perforated at 5,522-28 ft., flowed 106 bbl. of 39.5°-gravity oil per day through ⅛-in. choke with pressure of 725 psi.

The well was drilled to 6,477 ft., is cased to 6,037.5 ft., and is completed with two parallel strings of 2⅜-in. tubing, one set at 5,480 ft. and the other at 5,898 ft.

Location is on the north end of the field, and about 2½ miles south of Refugio townsite.

Small Oil Producer Opens Another Bee County Field

Another Yeagua-sand area is being opened in Bee County with the completion of a small oil producer by Gust Tsesmelis Oil & Gas Co. in his 2-A Ida C. Wood, a wildcat 6 miles southeast of Beeville.

Pay zone is perforated at 3,995-4,020 ft., from which the well flowed, in a 12-hour gage through 7/64-in. choke, at the rate of 16½ bbl. of oil per day with pressure of 585 psi. Hole was drilled to 4,500 ft.

The discovery is southeast of the active Poesta Creek area.

SOUTHWEST TEXAS

Dimmit County Discovery Opens Dry Gas Production

Michel T. Halbouty is opening another Olmos-sand reservoir in northwestern Dimmit County with the completion of his 1-A Damon White, a wildcat 7 miles southwest of Carrizo Springs, as a dry-gas well.

Location is northeast of the Celeste area, opened by Halbouty last September with oil production from Olmos sand at 2,925 ft. The gas discovery is in sand perforated at 2,726-32 ft.

The well has been shut in without a gage of production, but on a flow through 7/32-in. choke it had pressure of 325 psi.

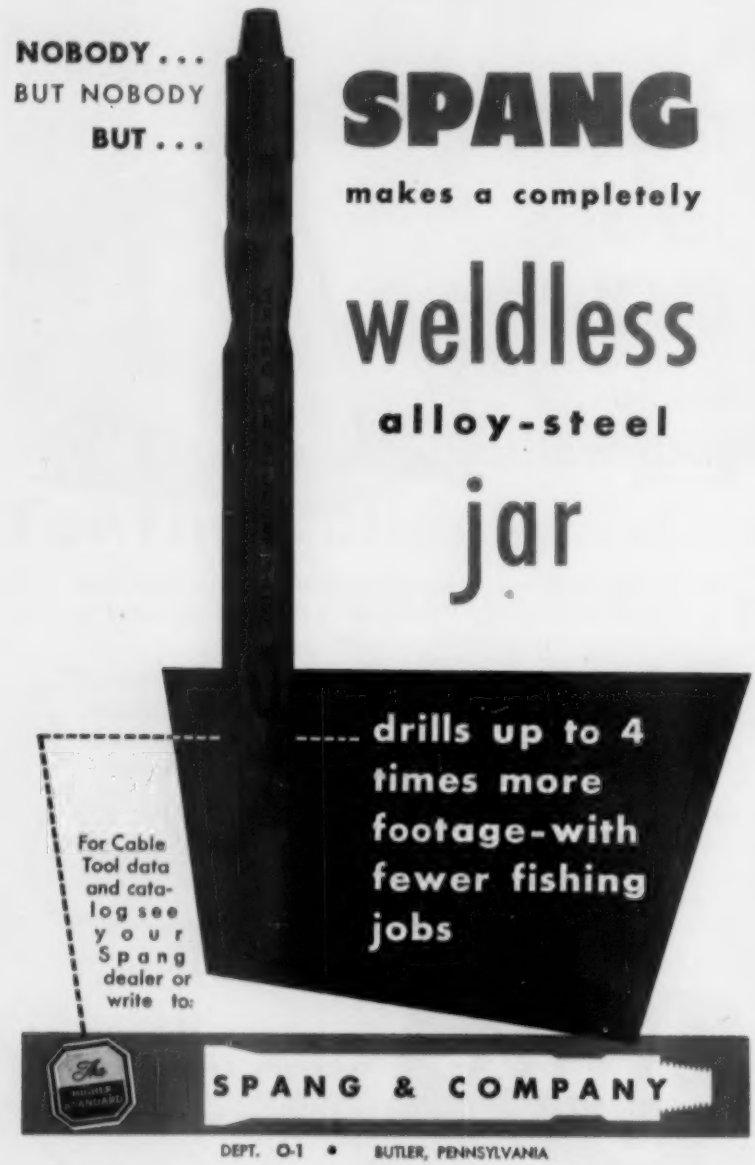
Specific location of the discovery is in I.&G.N. Survey, Block 31.

Deeper Horizon Produces In New Jim Wells Field

S. H. Howell and associates are confirming their recent new-field discovery 9 miles northwest of Alice, in northwestern Jim Wells County, with the opening of a deeper producing horizon, in Cockfield sand, perforated at 7,168-78 ft.

Their initial discovery well, 1 Paul White, was completed in Vicksburg sand, perforated at 4,642-45 ft. It had a flow of 98 bbl. of 45.5°-gravity oil per day. The Cockfield well, 1 Louis Mora, is rated good for 8,300,000 cu. ft. of gas per day, recovering 28 bbl. of 55.8°-gravity condensate per 1,000,000 cu. ft. of gas. Pressure is in excess of 3,600 psi.

Jefferson Lake Sulphur Co.'s recently organized oil and gas division has a substantial interest in the operation.


NOBODY . . .
BUT NOBODY
BUT . . .
SPANG
makes a completely
weldless
alloy-steel
jar
drills up to 4 times more footage-with fewer fishing jobs
For Cable Tool data and catalog see your Spang dealer or write to:
SPANG & COMPANY
DEPT. O-1 • BUTLER, PENNSYLVANIA
For over 60 years Manufacturers of Spang Weldless Jars and a Complete Line of Cable System Drilling and Fishing Tools for Oil and Gas Wells, Prospect Drilling and Shot Blast Holes.

Rugged as a mailed fist...

TOTCO

Shock... pressure... heat—none of these affect the accuracy of your durable Totco Recorder. Constantly modified and improved, Totco Recorders are built to take it! No wonder more Totco instruments are now in use than any other make.

Be sure you know, use TOTCO!

Technical Oil Tool Corporation • *1057 North La Brea Avenue, Los Angeles 38, California*

Exclusive Distributors: *California*—The Republic Supply Co. of California; *Domestic*—The Continental Supply Company; *Canada*—Oil Well Supply Company; *Export*—Lucey Export Corp., New York City

THOMPSON
SAND RESISTANCE
OIL WELL PUMPS

TRAVELING PLUNGER ROD TYPE BOTTOM HOLD-DOWN PUMP STANDARD SIZE

Figs. 400P, 600P, 700P, 800P

Single or double, self-aligning, combination cup and plunger or all-metal traveling plunger type pumps made in four sizes; regular 1⅛", 1¾" oversize, 2" regular and 2¼" oversize bore. These pumps seat in API seating device. In very sandy wells, or when tubing is out, we recommend our SAND HOUSING MECHANICAL SEATING SHOE, which prevents sanding in of pumps as sand can be pumped and the pump pulled at any time by our sand flushing arrangement.

TOP HOLD DOWN INSERT ROD PUMP

Standard Size, Figs. 400T, 500T

Self-aligning double plunger insert pumps. Made in three types: combination cup and single plunger; combination cup and double self-aligning type; and metal-to-metal double plunger self-aligning type. All are equipped with Regular or Extra Long Alloy Plungers, ground individually to fit the barrels, assuring longer life on both pump and surface equipment.

SELF-ALIGNING SAND SEALED-OFF PUMPS

Figs. 600-800-900

Inverted Combination Single or Double Plunger Self-Aligning Pumps can be equipped with a Sand Flush Valve which seals the Plunger off on top and cleans the barrel every pump stroke.

Sand is deposited into blind cage above the plunger and is discharged every stroke of the pump. The bottom of plunger is sealed to eliminate slippage. Easy on surface equipment. Lower lifting cost with Sealed-Off Pumps.

Can be run in any API seating device or use an adapter to fit the seating device preferred. We carry in stock at all times Special Heavy Duty Sand Housing Mechanical Seating Shoes which are very important to bad sand conditions—a place for sand to settle, so when pump is on down stroke, the bottom barrel bushing with a double spiral spray reaches into the sand housing, moving the sand out into the tubing.

SPECIAL HEAVY DUTY SEATING DEVICE

This special Combination Sand Housing and Seating Device is invaluable in bad sand conditions, especially where pump is sanding into the tubing. In extremely sandy wells the pump may be unseated occasionally to allow a small portion of tubing fluid to flush through the sand housing and return the accumulated sand to the well.

Pumps for all fields, depths and conditions. For further information write for complete catalog.

NEW BALL HOUSING CAGE

The new sensational positive action cage with patented stationary ball housing guide that encloses the ball and allows fluid to by-pass the ball thus eliminating all fluid restriction; and also positively eliminates ball spinning and chatter, preventing ball from beating out the cage. There are no moving parts in the cage.

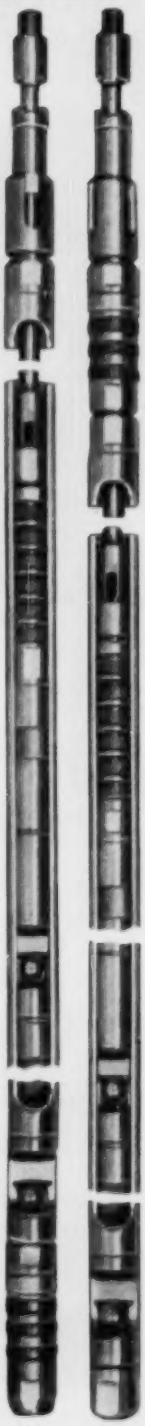


Fig. 400P 600P 700P 800P

Fig. 400T 500T

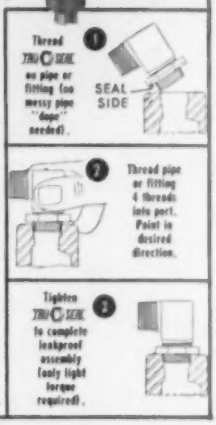
THOMPSON PUMP COMPANY
OKMULGEE, OKLA.

STOPS PIPE THREAD LEAKS instantly!

PAT. PENDING

Prevents future leaks!

TRU-O-SEAL does away with messy pipe "dope" compounds, eliminates damage caused by overtightening of conventional leaky joints, and is immune to ALL known hydraulic fluids and to steam, air, water, solvents, and practically all gases and chemicals. It withstands temperatures from —100° F. to plus 500° F., saves cost and labor of special or welded fittings, and has been fully field tested and proven by leading manufacturers. Comes in ⅛" to 2½" pipe thread sizes.

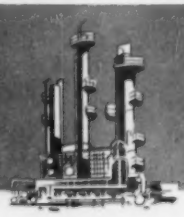

1
Thread TRU-O-SEAL on pipe or fitting (no messy pipe "dope" needed).
SEAL SIDE
2
Thread pipe or fitting 4 threads into port. Point in desired direction.
3
Tighten TRU-O-SEAL to complete leakproof assembly (only light torque required).

Write for data and prices

TRU-O-SEAL DIVISION
Flick-Reedy Corporation

2035 N. Hawthorne — Melrose Park, Ill.

"Miller Fluid Power" is also a Div. of Flick-Reedy Corp.



Experience Plus
Technical Knowledge
Means *Timely*
FINANCING

Call or Write
OIL and GAS
DEPARTMENT

Mercantile National Bank
DALLAS, TEXAS

NEW MEXICO

SOUTHEAST NEW MEXICO

Humble Wildcat Logs More Pay in Pennsylvanian

Humble Oil & Refining Co. 1-AQ State, Lea County wildcat in 3-16s-33e, has had oil or gas shows on three drill-stem tests in the Pennsylvanian.

A 3½-hour test at 11,016-41 ft. had gas in 25 minutes and recovered 900 ft. of clean oil, plus water blanket. An earlier test, at 10,950-74 ft., developed 3,720 ft. of oil, and at 10,800-72 ft. recovery was 3,170 ft. of oil. Location is 2 miles east of the firm's South Saunders (Pennsylvanian) discovery.

Magnolia Petroleum Co. 1 Dickinson heirs, Lea County wildcat in 33-10s-36e, west of Echol-Devonian field, was drilling below 11,648 ft. after getting shows in the Pennsylvanian.

On test at 11,530-78 ft., recovery included 1,525 ft. of clean oil, plus 365 ft. of salt water. At 11,494-11,536 ft., recovery was 840 ft. of clean oil; at 11,786-11,804 ft., recovery was 450 ft. of oil, and at 11,232-11,311 ft., recovery was 540 ft. of oil plus 30 ft. of sulfur water.

NEW OIL MAP

A map of Lea County, New Mexico, is available from Midland Map Co., Box 1211, Midland, Tex., which shows operator and farm names of producing areas. The map is an excellent job, with accurate well locations and legible printing. The scale, 1 in. to 6,000 ft., is large enough for spotting development or for contouring. Additional features are: Dry holes with operator's name and total depth, discovery wells with farm name and number, principal highways, and field names.

The map is kept up to date and each copy is stamped with the date sold and the last day of posting well information from the New Mexico Oil Conservation Commission. Size of the map is 42 by 98 in.

SOUTH LOUISIANA

LOUISIANA GULF COAST

Lewisburg Area Wildcat Completed as Producer

Gas and condensate production is being opened in a deep wildcat drilled by Olin Oil & Gas Corp. and Drilling & Exploration Co., Inc., 7 miles southwest of Opelousas, in southwestern St. Landry Parish.

The wildcat, 1 Jacob Higginbotham, was drilled to 11,536 ft., and has casing at 9,651 ft. Its pay zone, in Frio sand, is perforated at 9,380-84 ft.

Testing through 3/16-in. choke, it flowed at the rate of 2,000,000 cu. ft. of gas per day with liquid recovery 117 bbl. Flowing pressure was 3,300 psi.

LOCATION of Olin Oil & Gas Corp. and others gas-condensate discovery-well in southwestern St. Landry Parish.

Location, about 1½ miles southeast of Lawtell, is 2 miles north of Lewisburg field, production from Oligocene-Frio sands from 9,000 to 10,200 ft.

Vermilion Parish Gets Another Distillate Field

Vermilion Parish appears to be getting another deep gas-condensate field. It is located in the southeastern part of the parish, near the north shore of Vermilion Bay. It is about 6 miles east of Live Oak field, and about the same distance west of South Tigre Lagoon field, in Iberia Parish. The expansive,

NO STRANGERS TO THE NEW WORLD...

History will be repeated in 1957 when "Mayflower II", a replica of the original Pilgrim Fathers' ship, sails from Britain to be presented to the people of America as a goodwill gift. History repeats itself, too, for The Gourock Ropework Co., Ltd. of Port Glasgow, Scotland. They have been chosen to manufacture *every rope on board "Mayflower II"*.

More than two hundred years ago they were acknowledged experts in the rigging of sailing ships and were exporting ropes to the young colonies on the Atlantic seaboard of America. Now, for "Mayflower II", techniques and methods unused for nearly one hundred and fifty years have been revived from old hand written Gourock records to duplicate exactly the standing and running rigging which will be vital to the safety of this little vessel on her hazardous voyage.

GOUROCK

Rope and steel wire rope for every purpose.

For name of nearest agent in any particular area of operation please write to The Gourock Ropework Co., Ltd., Port Glasgow, Scotland

main Tigre Lagoon field, straddling the parish line, is about 5 miles northeast.

The discovery is by the Fifteen Oil Co. at its Vermilion Bay Land Co., in 22-14s-4e. Commercial production is indicated in a Miocene sand at 11,301-90 ft., latest zone to be tested. Flowing through ⅛-in. choke, the well gaged 795,000 cu. ft. of gas and 57.6 bbl. of 45.7°-gravity condensate per day. Flow was under pressure of 3,650 psi.

Two deeper sands, one at 12,575 ft., and the other at 11,450 ft., were tested previously. Tests failed to indicate commercial production. Hole had been drilled to 13,564 ft.

Deep Cameron Wildcat Makes Shallow Gasser

Humble Oil & Refining Co. has completed its 1 Stine heirs, a deep wildcat test 2 miles south of Cameron field, on the coast of Cameron Parish, as a small dry-gas discovery-well in a relatively shallow Miocene sand, perforated at 6,667-78 ft.

Attempts previously had been made to complete the well in two deeper sands, one at 9,700 ft. and the other at 9,800 ft., both of which gave indications of production. These were given up because of excessive water encroachment. The well had been drilled to 12,000 ft.

Potential gage in the 6,600-ft. sand was 369,000 cu. ft. of gas per day with flow through ⅛-in. choke. Pressure was 2,500 psi. Gas is dry.

Location is near the mouth of Calcasieu River, on its west bank.

Cameron field, discovered in 1952, is productive of oil, gas and condensate from a multiplicity of sands ranging in depth from 9,100 ft. to below 11,200 ft.

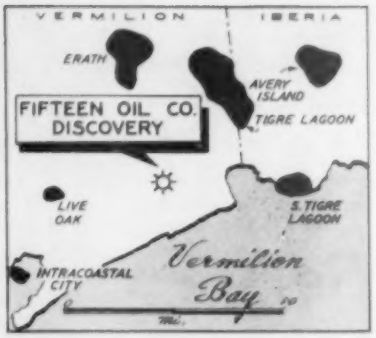
Deep Oil Pay Opened In Old Abandoned Bel Area

Serio-Punches Oil Co. has uncovered another Cockfield oil reservoir about 3½ miles southwest of Reeves in the extreme western part of Allen Parish, near the Beauregard Parish line.

Its discovery well, 1 Bel Lumber, in 29-6s-7w, is about a mile southeast of the old Bel area, a one-well field opened in 1952, now abandoned.

The Cockfield pay is perforated at 10,065-70 ft. It produced at the rate of 218 bbl. of 49°-gravity oil per day during a preliminary drill-stem test with 3/16-in. choke.

Production of the one well completed in the original Bel area was from a 5,200-ft. Oligocenee sand. The Serio-Punches well was drilled to 10,300 ft., and is reported to have logged two other potentially productive sands.



PORTION of southeastern Vermilion Parish showing location (indicated) of Fifteen Oil Co.'s gas-condensate discovery.

SOUTHEASTERN STATES

MISSISSIPPI

North Yellow Creek Field Gets Production Extension

Production of North Yellow Creek field, in south Clarke County, on the east side of the state, is being extended

AT THE WELL—W-K-M Through-Conduit, parallel expanding gate valves on christmas trees, flow wings, high pressure flow lines, etc.
IN THE FIELD—OCF Rectangular and Round Port lubricated plug valves on manifolds, headers and flow lines serving field processing units.
IN THE PLANT—W-K-M valves on feed lines to gasoline and cycling plants, refineries, chemical, petro-chemical and processing plants.

a mile north. The extension is by Central Oil Co. at its 1 G.M.&O. in 12-10n-8w, now being completed as a small oil well in the field's Eutaw-Creagh sand.

Productive interval is 4,740-50 ft. Swabbing recovered 4 bbl. of clean oil per hour. A previous drill-stem test, open 20 minutes, recovered 30 ft. of oil and 600 ft. of oil-cut mud, plus the 240 ft. of water cushion. No formation water was indicated. Gravity of the oil is 22°.

The field, discovered in 1952, now has 12 wells.

Successful Wildcats

CALIFORNIA

Kern County: General Petroleum Corp. 31-3 Alferitz, NE NW 3-25s-18e, 259 BOPD, 47.5° gravity, 1 per cent cut, 11/64-in. choke, perfs. 4,245-4,529 ft., TD 4,932 ft. (Deeper Eocene pool discovery in Alferitz anticline area of Devils Den field.)

KENTUCKY

Breckinridge County: George Baker 1 Taberling, NE NE SW 10-O-35. IPP 25 BOPD, Jackson sand 267-81 ft. TD 283 ft. (Discovery of Tar Fork field.)

Muhlenburg County: R. Halbert et al 1 Everett, NE SE NE 25-H-29. IPP 15 BOPD, lower O'Hara lime 1,068-90 ft. TD 1,090 ft. (Discovery of Everett School field.)

KANSAS

Barber County: Farley pool was opened by Wm. Gruenerwald 1 Farley, C NW NW 32-34s-14w. IP 2,840 M.c.f. of gas per day, Mississippi. TD 5,532 ft.

Barton County: North Hoisington pool opened at Thunderbird Drilling Co. 1 Russell, NE SW NW 16-17s-13w. Completing in Arbuckle. TD 3,415 ft.

Cowley County: Rippe pool opened at L. C. Smitherman 1 Rippe, SW SW SW 14-35s-3e. IPP 40 BOPD, Bartlesville sand. TD 3,449 ft.

Edwards County: Fatzer pool opened at Anschutz Drilling Co. 1 Fatzer, SE SE SE 15-26s-17w. Completing in Viola. TD 4,895 ft.

Wayne pool opened at D. R. Lauck-Sunray Mid-Continent Oil Co. 1 Cross, NE NE NE 28-24s-17w. Completing in Mississippi. TD 4,805 ft.

Ellis County: Seitz pool opened at Franco-Central 1 Seitz, SE SE SW 2-13s-16w. IPF 18 BOPD, Lansing. TD 3,442 ft.

Hodgeman County: Hallet pool opened at Kewanee Oil Co. 1 Larkin, SW NE SE 15-22s-25w. IP 250 BOPD, Mississippi. TD 4,693 ft.

Wieland pool opened at Mayfair Minerals 1 Wieland, SE SE SW 16-21s-22w. Completing in Mississippi. TD 4,550 ft.

Kingman County: Settle pool opened at George Siegrist 1 Settle, SE SE SE 18-29s-7w. OWWO. Completing in Mississippi. TD 4,641 ft.

Rooks County: Cresson pol opened at Jones, Shelburne & Farmer 1 Baldwin, NW SW NE 11-9s-20w. IP 120 BOPD, Arbuckle. TD 3,626 ft.

North Williams pool opened at Osage Oil & Gas Co. 1 Stucky, SE SE SW 32-9s-18w. Completing in Simpson. TD 3,728 ft.

Rush County: Pechance pool opened at Skelly Oil Co. 1 Pechance, SE NW NE 2-19s-17w. IPP 15 BOPD, Arbuckle. TD 3,908 ft.

Stafford County: North Gates pool opened at D. R. Lauck 1 Schulz "C," SE SE SE 22-21s-13w. IPP 25 BOPD, Arbuckle. TD 3,638 ft.

ALBERTA

Imperial 11-18 West Prairie, LSD 11, 18-72-17w5. TD 8,548 ft. Capped gas well.

SASKATCHEWAN

Gridoil 10-35 Manor, LSD 10, 35-7-34w1. Indicated Mission Canyon oil well.

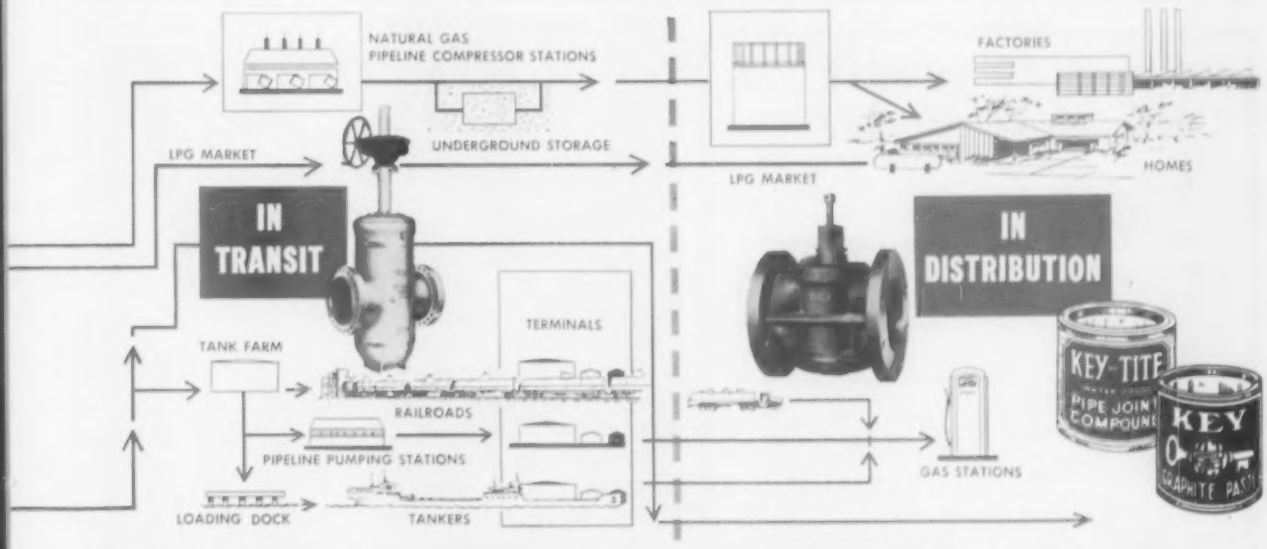
White Rose Can. Superior 4-15 West Roughbark, LSD 4, 15-6-14w2. Indicated Charles oil well.

NORTH LOUISIANA

Tensas Parish: Jett Drilling Co., Inc., B-1 Fisher, 1⅝ miles north of Justina, ½ mile east of Lake Formosa in SW SE SE 22-12n-10e. IPF 170 BOPD, 8/64-in. choke, 38.4°, lower Tuscaloosa 8,334-40 ft. TD 8,515 ft. (Discovery of Lake Formosa field).

Union Parish: Carter Oil Co. 1 Minnie Mitchem et al Unit, 2¾ miles southwest of Bernice, 4¾ miles west of Bernice field in C SW 20-21n-3w. IPF 132 BDPD, 2,663 M.c.f. of gas per day, ¼-in. choke, Smackover 10,344-423 ft. TD 10,915 ft. (gas-condensate discovery).

Webster Parish: A. J. Hodges, Industries, Inc. 1 Greenard, ⅝ mile west of Cotton Valley, 1¾ miles northwest of Cotton Valley field in 18-21n-10w. IPF 239 BOPD, 14/64-in. choke, 41°, Davis sand of Cot-



acf valves on the service lines in these plants, handle a wide range of commodities.

KEY Return Bends in furnaces and heaters. KEY-KAST Welding Fittings throughout the entire piping system where tees, wyes, ells, laterals, and other shapes are required.

IN TRANSIT—W-K-M pipeline valves all along the lines; in compressor and pumping stations; on loading docks, tank farms and terminal storage.

IN DISTRIBUTION—acf valves in gas storage and distribution systems for homes and industry.

KEY-TITE and KEY GRAPHITE PASTE for sealing threads and gaskets on lines handling water, steam, natural and artificial gas, oil, acid and refined petroleum products.

W-K-M
DIVISION OF acf INDUSTRIES INCORPORATED
PLANT: MISSOURI CITY, TEXAS. MAILING ADDRESS: P. O. BOX 2117, HOUSTON, TEXAS

MANUFACTURERS OF

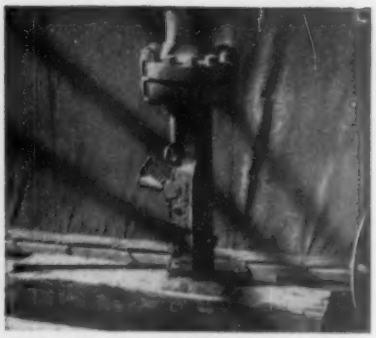
W-K-M	acf	KEY
THROUGH-CONDUIT GATE VALVES	LUBRICATED PLUG VALVES	RETURN BENDS AND FITTINGS

Shortcuts for Drillers
with Simplex Jacks

SOMETIMES IT TAKES TWO . . . With right and left hand toes, respectively, Simplex Nos. 126 and 127 ratchet lowering geared jacks can be used as a pair for lifting and lowering rigs or other heavy equipment. 25-ton capacity on cap or toe. Powerful geared mechanism makes jack faster and easier to use than standard speed types.

BIG PULL . . . For your cable tightening and wire pulling jobs. Here's the Simplex Jack that works fast on slack cables, gives hefty pull for final tightening. No. 324 is light, handy to use.

OTHER SIMPLEX JACKS FOR DRILLERS include the famous "center-hole" Jenny and the Re-Mo-Trol, a remotely controlled ram and puller. There is also a complete line of Simplex hydraulic and screw jacks. General Catalog No. 56 lists them all—write for a free copy.



"THE MUD LINE STANDPIPE WAS POUNDING LIKE *!?*" according to the pumper, "so we jacked it up". This is only one way the versatile Simplex Emergency Jack offers an easy short-cut to problems in the oil country. With 15-tons capacity at four lift points, Model 310A also lifts, skids and levels rigs, moves and braces machinery, pulls positions, clamps and supports pipe.

LIFTS IN A HURRY . . . For extra speed and ease of handling on many heavy duty oil field lifting jobs. Simplex Model 2029 lifts 20-tons on cap *or* toe. Single acting, ratchet lowering lever type.

TEMPLETON, KENLY & CO.
2539 GARDNER ROAD, BROADVIEW, ILLINOIS
A. C. Templeton, 5627 Del Roy Drive, Dallas, Tex.

GIVE YOURSELF A BREAK!

with **BrakeSol**

HOLDS PARAFFIN IN SUSPENSION from FORMATION to REFINERY

Now is the time to give yourself a break with BrakeSol and clean the paraffin from your production system. Then keep it clean by setting up a program of constant treating.

FORMATION. Get more production by cleaning up the formation with BrakeSol. Use with frac jobs to get more effective results.

HEATER-TREATER. BrakeSol will allow the use of less heat, thereby increasing the gravity of your oil.

TANKS. Clean up that tank bottom by treating it back into the oil where it can be sold. Equally effective on the largest pipeline tank and the smallest stock tank.

CARMI, ILLINOIS 6-2905
CASPER, WYOMING 2-3452
GREAT BEND, KANSAS 4385
FT. MORGAN, COLO. UNderhill 7-6389
HOUSTON, TEXAS HOmestead 5-6648
LOVINGTON, NEW MEXICO 6-5954
NEW IBERIA, LOUISIANA EMerson 9-3498
ODESSA, TEXAS FE 7-7192
ARDMORE, OKLA. 6489
OKLAHOMA CITY, OKLA. VI 3-6629 WH 9-5561

CONTACT YOUR NEAREST BRAKESOL TREATING ENGINEER

Your BrakeSol Treating Engineer can show you the most effective methods of application and how to accomplish all of the above in one simple operation. Make money and save trouble this winter by the use of BrakeSol.

- **Export Distributor: The National Supply Co.**
  Export Division 600 Fifth Avenue
  New York, New York, U.S.A.

BRAKESOL, Inc.
P.O. Box 9506 Okla. City, Okla.

USE KINZBACH WHIPSTOCKS TO SIDETRACK YOUR HEADACHES

Kinzbach Whipstocks can be set at any depth and require no support for the bottom. Positive setting slips prevent slipping or turning in the hole. The Kinzbach hinge arrangement assures that the top of the Whipstock will be close against pipe wall at all times, permitting easy passage of drilling tools. Setting trigger always locates the Whipstock between couplings so that the window will be within one joint. Kinzbach Whipstocks are available in all popular casing sizes through your supply store.

KINZBACH TOOL CO INC

Export Office:
74 Trinity Pl.
NewYork,N.Y.

KINZBACH TOOL CO., INC. • P. O. BOX 277 • HOUSTON, TEXAS

ton Valley 9,574-85 ft. TD 9,832 ft. (Extension discovery to Cotton Valley field).

WEST VIRGINIA

Mercer County, Plymouth district: United Fuel Gas Co. 8424 W. S. Woodell, elevation 2,456 ft., 561,000 cu. ft. gas, Maxon sand. TD 1,828 ft.

PENNSYLVANIA

Indiana County, Armstrong Township: Columbian Carbon Co. 1-1833 Susie Yosurack 4,500,000 cu. ft. gas after fracture. Onondago 7,618 ft. chert 7,632 ft., Oriskany sand 7,757-88 ft. TD. 7,802 ft.

NORTH TEXAS

Baylor County: McMahon-Bullington Drilling Co. 1 Hajek, Sec. 104, T&NO Sur., 3 miles SW Seymour. IP 52 BOPD, 1-in., TP 30 psi., 35°, GOR 150, Tannehill sand 1,286-92 ft. TD 1,385 ft.

McMahon-Bullington 2 Hajek, Sec. 104, T&NO, 2½ miles SW Seymour. IPP 24 BOPD, 35°, GOR 100, perf. 1,289-96 ft. TD 1,386 ft.

Clay County: A. D. Beck 1-B Lyon, Blk. 41, Byers Brothers Subd., 2 miles NE Petrolia, ¼ mile NE production. IP 288 BOPD, 24/64-in., TP 120 psi., 40°, GOR 450, pay 1,826 ft. TD 1,834 ft.

Young County: H. O. Grace 1 Ricketts, Susan Salles Sur., A-252, 3½ miles N Loving. IPP 96 BOPD, 40°, GOR 750, perfs. 3,497-3,505 ft. TD 3,515 ft.

GASOLINE GAUGING PASTE

Gives accurate gauges of light hydrocarbons (Butanes, gasoline, kerosene, crudes). Turns red on contact. Will not creep up gauge line.

WATER FINDING PASTE—

Turns red on contact with water level. Assures accurate gauges.

Write

KOLOR KUT PRODUCTS CO.

Box 5415 • Houston 12, Texas

Write or Wire

for Monthly Stock Lists

- **VALVES**
- **PRESSURE TUBING**
- **STEEL**

Peerless Supply Co., Inc.

L. D. 75 & 76 P. O. Drawer 36-A

Shreveport, La.

WEST TEXAS

Gaines County: B. B. M. Drilling Co. 1 Jones, 25-A7-PSL, 26 miles NE Seminole. IP 227 BOPD, 28/64-in., 37°, TP 90 psi., GOR 400, lower Clear Fork 8,290-8,310 ft. TD 12,953 ft.

Gaines County: Magnolia Petroleum Co. 1 Parmer CSL, Labor 6, League 317, Parmer CSL Sur., 6 miles NE Florey. IP 102 BOPD, 20/64-in., TP 500 psi., GOR 376, 32.5°, Queen sand 4,634-44 ft. TD 12,822 ft., PB 4,704 ft.

Irion County: Ohio Oil Co. 1 Ada Moorehead, Acc. 1, 79-1-H&TC, 5 miles SW Mertzon. IP 95 BOPD, ¼-in., TP 75 psi., GOR 363, 42°, Lower Clear Fork 2,858-85 ft. TD 7,902 ft., PB 2,937 ft.

Midland County: Seaboard Oil Co. 1 Tillman, 12-X-H. P. Hilliard Sur., 3 miles N Midland. Recompleted as new-pay discovery in Hoffercamp-Strawn field. Old TD 12,700 ft., PB 9,991 ft., IPP 99 BOPD, GOR 515, Spraberry perfs. 8,626-50 ft.

Trebol Oil Co., Rodman, et al., 1-P Josie Fay Peck, 20-41-T4S-T&P, San Andres pay opener in Sweetie Peck field. Old TD 13,347 ft., PB 5,978 ft., pay 5,760-80 ft., IPP 155 BOPD, 34°, GOR 155.

Warren Petroleum Corp. 1 TXL "G," 39-41-T3S-T&P, recompleted as Wolfcamp pay opener in War-San field. Old TD 10,498 ft., PB 9,850 ft., pay 9,795 ft., IP 283 BOPD, 30/64-in., TP 110 psi., GOR 1909, 46°.

Mitchell County: W. W. Krug and M. L. Melton 1 Mills, O'Keefe & Smith Sur., 8 miles SE Ira. IPP 56 BOPD, 28°, pay 1,589-1,600 ft. TD 3,003 ft.

Terry County: George P. Livermore 1 Pool, 15-D14-C&M Sur., 10 miles N Tokio. IPP 54 BOPD, 33°, GOR 1228, San Andres pay topped 5,095 ft. TD 5,237 ft.

WEST CENTRAL TEXAS

Shackelford County: M. L. Kinnebrew 1 Roark, 52-12-T&P, 10 miles SW Albany. IPP 62 BOPD, 38°, GOR 750, Cook sand 1,535-36 ft. TD 1,564 ft.

EAST TEXAS

Anderson County: Thomas D. Humphrey & Sons 1 Franklin, John McCoy Sur., A-505, 3 miles SE Slocum. IP 162 BOPD, 10/64-in., 43.9°, TP 910 psi., GOR 1180, Woodbine perfs. 5,857½-59½. TD 5,882 ft. Suggested new field name, Slocum, East.

NORTH TEXAS

Archer County: Bridwell Oil Co. 1 Marshall heirs, TE&L Sur. 1801, 4 miles N Farmer. 81 BOPD, 42°, 6/64-in., TP 800 psi., GOR 1122, pay 5,118 ft. TD 5,221 ft.

Clay County: L. T. Burns estate 22 Lutz, T Bates Sur., A-13, 4 miles SE Blue Grove. IP 150 BOPD, 12/64-in., TP 400 psi., 44°, GOR 556, Strawn 6,025-32 ft. TD 6,052 ft.

Grayson County: A. O. Phillips 1 McAden, Blk. 44, W. Holmes Sur., A-1511, 8 miles N Whitesboro and ⅜ mile SE production. IP 198 BOPD, 12/64-in., TP 140 psi., 34°, GOR 300, Strawn 5,005-23 ft. TD 7,562 ft.

Knox County: Phillip Johnson 1 King, 115-45-H&TC, 1½ miles SE Munday, 2¼ miles NW Cartwright field. IPP 29 BOPD, 34°, Tannehill sand 1,808-23 ft. TD 1,916 ft.

Schulz & Brannan 1 Lowrance, 72-2-D&W, 1 mile N Munday. IPP 45.4 BOPD, 40°, GOR 300, pay 2,005 ft., perfs. 1,990-2,000 ft. TD 2,101 ft.

Young County: B. M. Hester 1 Robertson, Blk. 31, F. L. Green Sur., A-105, 4 miles NW Eliasville. IPP 102 BOPD, 41°, Strawn 2,596-98 ft. TD 2,635 ft.

INCREASE PRODUCTION

CLEAN OUT CHOKING SAND

Excessive sand and sediment holds back your oil. For fast, easy clean out with fewer round trips and less downtime, use world famous Miller Sand Pumps.

Write for descriptive price list.

SAND PUMP SIZES IN STOCK

O.D.—2½, 3, 3½, 4¼, 5, 5½, 7 in.
Lengths—20, 25, 30 ft.

Composite Catalog Page 3369

MILLER SAND PUMPS

MILLER SAND PUMP CO.

General Offices, Box 4516
Oklahoma City 9, Okla.

EXPORT OFFICES
30 Rockefeller Plaza
NEW YORK 20, N. Y.

How to CONTROL and ALARM the TOWER LIGHTS of UNATTENDED Microwave and Communication Stations

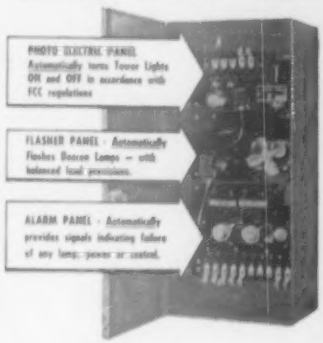


PHOTO ELECTRIC PANEL
Automatically turns Tower Lights ON and OFF in accordance with FCC regulations
FLASHER PANEL - Automatically Flashes Beacon Lamps — with balanced load provisions.
ALARM PANEL - Automatically provides signals indicating failure of any lamp, power or control.

Model LC 201
TOWER LIGHTING CONTROL UNIT
(for Two Light Levels)

Model LC 101 (for Single Light Level)
Model LC 301 (for Three Light Levels)
Models also available with separate Alarm Signal for each Beacon Lamp.

Write for descriptive Bulletins

HUGHEY & PHILLIPS, INC.

Manufacturers of
300MM Code Beacons, Obstruction Lights, Photo-Electric Controls, Beacon Flashers, Microwave Tower Control & Alarm Units Remote Lamp Failure Indicator Systems, and Complete Tower Lighting Kits.

3300 NORTH SAN FERNANDO BLVD. BURBANK, CALIF.

NO— SLURRY SETTLING

Imagine . . . a slurry pump which permits the proportion of slurries in the mix tank to remain constant . . . with pumping rates variable from maximum to 1/5 of maximum. Manzel guarantees such performance with its new SP-90 Slurry Pump. Field engineers are ready to consult with you.

WRITE FOR COMPLETE CATALOG

Manzel

LUBRICATORS • CHEMICAL FEEDERS • SLURRY PUMPS

326 BABCOCK STREET • BUFFALO 10, NEW YORK

A Division of Houdaille-Industries, Inc.

Texkan Oil Co. 2 Morrison-Harbison, T&NO Sur., A-1247, 3 miles E Graham. IPP 37.5 BOPD, 41°, GOR 150, pay 2,146 ft. TD 2,149 ft.

TEXAS GULF COAST

Jasper County: Sinclair Oil & Gas Co. et al., 1 H&TC Fee, H&TC Sur., A-590. IP 140 BOPD, 5/32-in., 41.6°, perfs. 5,897-99 ft. (Yegua). TD 7,100 ft. (New field.)

Jefferson County: Magnolia Petroleum Co. and Stanolind Oil & Gas Co. 9-A Texas Gulf Tract 10, Large Tract 10, High Island Area, Gulf of Mexico. IP 23,000 M.c.f. daily, open-flow potential, perfs. 5,197-5,211 ft. (Marine Miocene). TD 11,643 ft. (New pay in High Island Block 10-L field.)

Live Oak County: Christi, Mitchell & Mitchell 1 Lurline Rankin et al., Jane Curry League (1 mile NE of Dinero). IP 6,600 M.c.f. daily, open-flow potential, GOR 128 M.c.f. per barrel, 45°, perfs. 4,262-72 ft. (Hockley). TD 5,455 ft.

Montgomery County: Cyprus Oil Co. 2 Chase Manhattan Bank, Alex Smith Sur., A-499. IP 36,000 M.c.f. daily, open-flow potential, GOR 212 M.c.f. per barrel, 54.2°, perfs. 5,657-62 ft. TD 6,100 ft. (New field—North Indian Hills.)

Delhi-Taylor Oil Corp 2 Sealy Smith Foundation, James Hodges Sur., A-16. IP 3,600 M.c.f. daily, 11/64-in., perfs. 11,598-11,618 ft. TD 11,964 ft. (New field—Grand Lake.)

SOUTHWEST TEXAS

Frio County: Security Drilling Co. 1 Pickens, Austin Williams Sur., 964, A-10 IPP 110 BOPD, 45°, perfs. 5,638-42 ft. TD 5,643 ft. (New field.)

Medina County: Texas Coast Oil & Gas Co. 1 Scott, Sur. 527. IP 21 BOPD (net), 60 per cent water, 18°, perfs. 1,338-61 ft. TD 1,363 ft. (New pay in Taylor-Ina field.)

UTAH

San Juan County: Shell 3 Unit, NE NW NW 4-40s-23e. IPF 138 BO, 31 BWPD, Hermosa discovery, new field. TD 7,156 ft. Leadville.

MAPS

PALEOTECTONIC MAPS — JURASSIC SYSTEM. By Edwin D. McKee and others; Number I-175, United States Geological Survey's Miscellaneous Geologic Investigations Map Series.

This map measures 24 by 30 in. and includes nine double page of maps, two pages of charts, two of references, and three of text, bound in thick paper cover. The maps are printed in color on a scale of 1:500,000. Copies can be ordered by mail from the Washington Distribution Section, U. S. Geological Survey, Washington 25, D. C. or the Denver Distribution Section, U. S. Geological Survey, Federal Center, Denver, at $5 per copy with a discount of 20 per cent for orders of two or more copies. Copies can be purchased over the counter, but not by mail, from the following survey offices: 1031 Bartlett Building, Los Angeles; 724 Appraisers Building, San Francisco; 468 New Custom House, Denver; 504 Federal Building, Salt Lake City. The price of copies delivered to points outside the United States, its territories and possessions, and Canada is $1 per copy more than the price listed above. All orders for foreign shipments should be sent to the Washington Distribution Section. Prepayment is requested on all mail orders.

The Jurassic folio will prove of real worth alike to the professional geologist, the teacher of geology, and the layman interested in earth history.

WATCH FOR THIS SIGN OF A SPECIAL BUY

Recently, one of the National Supply Store managers literally "reached the end of his rope." So he gathered all the rope end remnants in stock, attached some National "money saving special" tags, and offered them at a big discount. In a matter of hours, the counter was cleaned off.

You won't often see these money saving special tags in any of our 126 stores. One reason, of course, is that merchandise moves rapidly. But the main reason is wrapped up in our store operation policy that is, in effect, a constant bargain for every customer.

Each National Store has a complete line of equipment and operating supplies that's tailored to the needs of the area it serves. A store's stock is never static, but constantly changed to bring you the newest developments in appropriate products.

Moreover, we insist on top quality products—from the major equipment in our own "National Blue" products family to the smallest accessory item you can name. We constantly try to anticipate your operating needs and give you the best possible benefits in prices and service.

Such a policy makes *everything* in a National Store a good buy—and thus we reserve the tags only for special situations and products like the rope ends. Actually, we could put bargain tags on all items—so convinced are we of their lasting service value to you.

But you, the customer, are the best and final judge of this. Your use of, and consistently high regard for, National Supply products and services has made us the world's largest manufacturer and distributor of oilfield machinery and equipment.

THE
NATIONAL SUPPLY
COMPANY

NATIONAL TRIPLEX PUMPS ARE PROFITABLE

Waterflooding is just one of the many jobs you can do profitably with National Triplex Pumps. They're equally effective for salt water disposal, high pressure testing, formation fracturing and acidizing, and as power-oil sources for sub-surface hydraulic systems. And wherever you put them to work, they deliver dependably—with little or no service downtime.

Simplified, rugged construction insures their sound performance, and their compact design requires a minimum of space. National Triplex Pumps have heavy-duty housings and frames, long-life bearings, stainless steel valves, National's time-proven lubrication systems, and a minimum of wearing parts.

Plungers, fluid ends and stuffing boxes are interchangeable, thus providing the flexibility to meet varying pressure and volume needs. They are also available for either corrosive or non-corrosive service.

You'll find, too, that National Triplex Pumps are easy to install and maintain. They're adaptable to V-belt or direct drive, and are easily fitted to unitized skid mounting for complete portability. For minimum maintenance and speed in plunger size changeover, these pumps have easily removable cartridge-type stuffing boxes.*

These are just a few of the reasons why National Triplex Pumps pay dividends on many oilfield and petrochemical pumping jobs. The National Supply field representative in your area will be glad to give you more information. Ask him soon.

*Patent Pending

ON A WIDE VARIETY OF PUMPING JOBS!

Check their performance...

Model Number	Rated Discharge Pressure Range*	Barrels Per Day Range*
F-15-L (Low Pressure)	500 to 825 psi	430 to 1770
F-15-M (High Pressure)	1120 to 2520 psi	140 to 785
F-60-L (Low Pressure)	835 to 1575 psi	1120 to 4230
F-90-L (Low Pressure)	685 to 1345 psi	1955 to 7715
F-60-S (High Pressure)	1575 to 4975 psi	355 to 2240
F-90-S (High Pressure)	1660 to 5375 psi	480 to 3190

*Based upon standard pump speeds and rated HP output

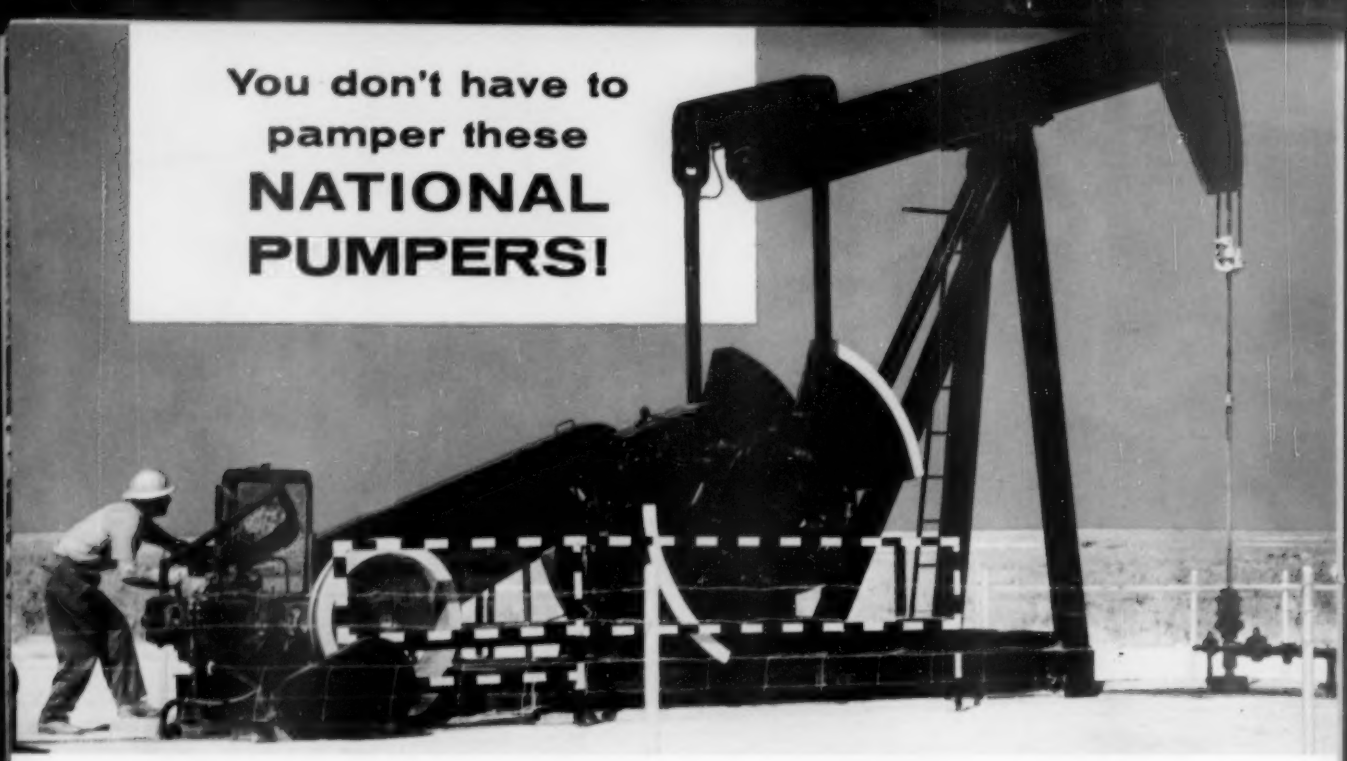
THE
NATIONAL SUPPLY
COMPANY

MAIN OFFICE: Two Gateway Center, Pittsburgh 22, Penna.
DIVISION OFFICES: Denver; Ft. Worth; Houston; Toledo; Tulsa; Torrance
CANADA: The National Supply Company, Ltd., 200 F. W. Clark Building, 709 Eighth Avenue, West, Calgary, Alberta
EXPORT: 600 Fifth Avenue, New York 20, N.Y., U.S.A.; City Wall House, Chiswell Street, London E. C. 1

NATIONAL BLUE OIL FIELD MACHINERY AND EQUIPMENT
SPANG STEEL PIPE AND ELECTRICAL CONDUIT

On the next page: more National equipment for profitable production!

You don't have to pamper these NATIONAL PUMPERS!



Pumping units, especially, have to be "pamper-proof." They have to be simple, compact and strong—you want them to operate constantly for long periods with very little attention. Check these features of National Pumpers, and you'll see why they easily meet these requirements:

- **Easy-to-install, extra strong main base.**
- **Rugged gear reducer for extra stamina and longer life.**
- **Exceptionally stable, well balanced samson post.**
- **Pitman assembly features easy maintenance, fast assembly.**
- **Rugged walking beam and beam hanger for extra years of service.**

Get the complete facts on National Pumpers today. For the full story on the high performance and low operating costs they offer, see the National Supply Store men or representatives in your area soon. New bulletins describing these quality pumping units are available.

THE
NATIONAL SUPPLY
COMPANY

MAIN OFFICE: Two Gateway Center, Pittsburgh 22, Penna.
DIVISION OFFICES: Denver; Ft. Worth; Houston; Toledo; Tulsa; Torrance
CANADA: The National Supply Company, Ltd., 200 F. W. Clark Building, 709 Eighth Avenue, West, Calgary, Alberta
EXPORT: 600 Fifth Avenue, New York 20, N.Y., U.S.A.; City Wall House, Chiswell Street, London E. C. 1

NATIONAL BLUE OIL FIELD MACHINERY AND EQUIPMENT
SPANG STEEL PIPE AND ELECTRICAL CONDUIT

YOU GET SOUND PERFORMANCE, TOO, FROM...

NATIONAL Sucker Rods

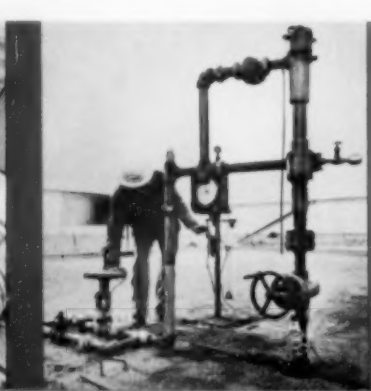
You get trouble-free service with National's precision-manufactured sucker rods. They're engineered for top resistance to corrosion, fatigue and impulse loads. Top-quality National Sucker Rods are available in a range of grades for every well condition.

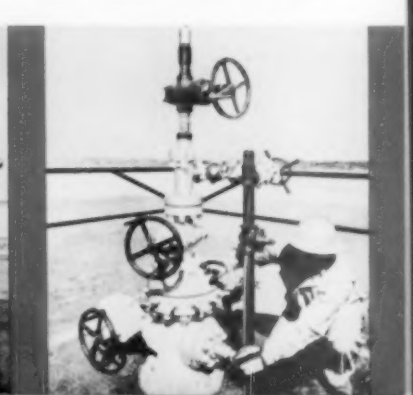
NATIONAL Plunger Lift

This National unit uses either formation gas or injected gas pressure for operation. Under the proper conditions, this method of operation can be exceedingly economical.

NATIONAL Wellhead Equipment

Interchangeable units provide many combinations to meet your specific needs in size, capacity and type. Ease of assembly and pre-tested safety are two major features of this equipment.





Texans pick a winner as . . .

. . . Street Wrestles Tough Job

FEW oil men will have tougher jobs through the coming year than that of E. Bruce Street, Graham, Tex., independent operator.

Street, a partner in Ibex Co. of Graham, is new president of the West Central Texas Oil and Gas Association, which represents roughly 1,000 producers and drilling contractors in 35 counties in West Central Texas.

As such, he will be called upon to wrestle during 1957 with a regional oil-marketing problem which very likely is tougher than that of any long-established producing area in the country.

West Central Texas operators last summer saw prices for their oil trimmed 7 cents a barrel. They also are plagued with a lack of pipeline facilities for hundreds of wells, and heavy pipeline proration in several areas where wells are connected (See page 148).

Street's association colleagues are convinced, however, that they have picked a winner.

Street, they say, has been a veritable dynamo at everything he's ever tackled —first automobile and investment businesses, then oil.

He is 44 and a native Grahamite. He left Graham in 1930 after going through the public school system there to attend New Mexico Military Institute at Roswell. He graduated from the institute in 1932 and from the Southern Methodist University School of Business at Dallas in 1934.

He returned to Graham that year to join his father and a brother, M. Boyd Street, in Street Investment Co.

Small beginning . . . The Streets entered the oil business inauspiciously in 1939 with the purchase of a shallow lease in northern Young County. The lease at that time was making 13 bbl. of oil daily. It is making 18 now.

Later on, the Streets joined with Lester Clark, of Graham, to form Ibex. From that small beginning, the oil operation has ballooned rapidly. Ibex now owns or has interests in roughly 1,200 wells in 28 counties in West, West-Central, and South Texas and in Eddy and Lea counties, New Mexico.

The company also has three gasoline plants. It specializes primarily in buying properties, always with an eagle eye out for possible water-flood projects. Ibex now operates 13 water floods and is starting another half a dozen. It employs a full-time water-flood engineer specialist.

Bruce Street is a small, modest man

who prefers to play down accomplishments. But his associates say that much of the company's growth is due to his unusual energy.

Street has been a vice president of the West Central Texas group for several years. He also is a director of the North Texas Oil and Gas Association.

Strenuous committeeman . . . He has worked strenuously the past year as chairman of the Texas Petroleum Industry Water Committee. This is a committee composed of representatives of all Texas producer groups. Its prime aims are to cooperate with state agencies dealing with fresh-water pollution and if possible, to see that the responsibility for dealing with pollutions (due to oil operations) is lodged with the Texas Railroad Commission, the agency most familiar with the oil industry and its problems.

Along with these duties, Street is serving as president of the Graham Chamber of Commerce and takes part in other civic activities.

Between trips to Austin, Washington, and other points required to carry out association business, he squeezes in a limited amount of tennis and golf. The Streets have two children, Virginia, 21, now attending S.M.U., and Bruce, Jr., 17, attending St. Stephens in Austin.

Bruce and brother Boyd, incidentally, are twins and the resemblance is striking. It's difficult to tell which is which when they're apart, and neither of the two is above taking advantage of the resulting confusion to pull someone's leg a bit on occasion.

One of their most recent victims was Texas Rep. Jerry Sadler who congratulated Boyd for a report Bruce delivered at a directors luncheon during the November 8 annual meeting of the West Central Texas association in Abilene. With tongue-in-check, Boyd admitted that his name was Street but denied giving any report, keeping the mystified politician in the dark for several moments.

Personals

Robert M. McClain has been named station engineer at the Drumright, Okla., station of Service Pipe Line Co.

Ellis E. Ball, field foreman with The Texas Co. in Hays, Kans., has been transferred to Salem, Ill., as assistant district superintendent.

I. D. Crawford has been named district geologist for Shell Oil Co. at Hay River, Alta. **T. J. Latus** has been appointed district geologist for the company at Peace River, Alta.

David Stern has been appointed assistant manager of American Potash & Chemical Corp.'s Whittier, Calif., research laboratory.

James M. Stewart has joined Drillers Production Co. in Wichita as petroleum engineer. Stewart has just been released from active duty with the United States Navy.

Dr. John W. Bertetti, director of Pan-Am Southern Corp., has joined Amoco Chemicals Corp. in Chicago as vice president in charge of manufacturing. **John J. O'Connell** has been appointed marketing vice president of Amoco Chemicals. He was formerly manager of the solvents department of Shell Chemical Corp. in New York City.

Paul E. Shepherd, chief engineer at the Taft, Tex., gas products plant of Sinclair Oil & Gas Co., has been promoted to superintendent at the Sweetwater, Tex., gas products plant. **John F. Parcell,** chief engineer at Sinclair's Drumright, Okla., gas products plant, has been transferred to the Eldorado, Tex., plant.

Harvey W. Lee, administrative assistant for Union Oil Co., has been elected president of the Pacific section of the American Association of Petroleum Geologists. Other officers are **Robert B. Kelly,** vice president, senior geologist for Continental Oil Co.; **William E. Kennett,** treasurer, geologist, Superior Oil Co.; **Aden W. Hughes,** secretary, consulting geologist, Goudkoff & Hughes.

Personals

Harry D. Hancock, manager of the natural-gas department of Cities Service Petroleum, Inc., has been elected president of Cities Service Gas Co. He

H. D. HANCOCK

K. E. CRENSHAW

succeeds **Glenn W. Clark,** who has resigned to become president of Mississippi River Fuel Corp. **Kirby E. Crenshaw,** vice president of Gas Advisers, Inc., Cities Service subsidiary, has been named executive vice president of Cities Service Gas. Hancock has been with the Cities Service system since 1917. He has been manager of the natural-gas department of Cities Service Petroleum since 1955. Crenshaw has been with Cities Service since 1930.

David B. Davidson, district geophysicist for Atlantic Refining Co., has been transferred from Bismarck, N. D., to Durango, Colo.

Percy C. O'Quinn, district engineer with Southern Production Co., Inc., in Pampa, Tex., has joined Cabot Carbon Co. as field superintendent in Midland, Tex.

George C. Ellis has been named senior vice president, director, and general manager of the West End Chemical Co. division of Stauffer Chemical Co. **H. D. Hellmers,** formerly vice president in charge of West End Chemical production, has been named Stauffer Chemical Co. division vice president, production.

J. E. Willingham, Jr., senior petroleum engineer in Humble Oil & Refining Co.'s Southwest Texas division office, Corpus Christi, Tex., has been promoted to supervising petroleum engineer. **G. B. Sutton,** junior petroleum engineer in Corpus Christi, has been promoted to associate petroleum engineer. **L. L. Attwell, Jr.,** associate petroleum engineer in Kingsville, Tex., has been promoted to petroleum engineer, and **R. C. Barbour, Jr.,** petroleum engineer in the Athens, Tex., district, has been promoted to district petroleum engineer of the Imogene district, Jourdanton, Tex.

Wallace H. Cochrane, former research geologist for Forest Oil Corp., has opened consulting offices in Denver.

Leo C. Gravis, formerly offshore exploration manager for Gulf Oil Corp., has joined Trunkline Gas Co., Houston, as chief geologist.

J. M. (Jack) Graves, geologist with Big One Drilling & Production Co. in Tulsa, has resigned to open consulting offices there.

W. W. Crump, seismic party chief with Amerada Petroleum Corp. in Springfield, Colo., has been transferred to Chickasha, Okla.

T. N. Ambrose, formerly geologist for The Texas Co. in New Orleans, has joined Cuban Kewanee Oil Co. in Havana, Cuba.

Louis (Buck) Schaufele, assistant district engineer in Signal Oil Co.'s central district, has been named central district engineer. He succeeds **Don Baird,** who has retired. Schaufele has been with Signal since 1940.

Edward Brown, assistant division geologist for Forest Oil Corp. in Corpus Christi, Tex., has joined Tex-Penn Oil & Gas Corp. as head of the company's new geological department. A graduate of the University of Oklahoma, Brown was with American Republics Corp. in San Antonio before joining Forest.

Dr. Fred M. Jacobsen, Jr., has been promoted to group leader in American Oil Co.'s computer programing and mathematical analysis group in the research and development department, Texas City. Jacobsen has been with American since 1955.

Elliott H. Powers and **Maxwell L. Euwer** have been elected vice presidents of Union Oil & Gas Corp. of Louisiana. Powers was named vice president and manager of exploration. He joins Union after 4 years as vice president in charge of exploration for Southern Production Co. in Fort Worth. Euwer joined Union in 1938 as chief petroleum engineer. Before that time he was with Shell Oil Co.

S. K. McCauley, administrative assistant to the vice president and general manager of marketing for Atlantic Refining Co., has been appointed manager of the Iran Atlantic Co. McCauley joined Atlantic in 1941 as a chemical engineer. He will be responsible for Atlantic's Iranian operations and will also assist in activities of the crude-oil purchases and sales department.

Douglas W. Marden, district geologist for Colorado Oil & Gas Corp., has joined Paul & Buchanan, consultants, in Liberal, Kans. The firm name has been changed to Paul, Buchanan & Marden.

Charles F. Passel has joined Ambassador Oil Corp. as geologist-manager of the Abilene, Tex., exploration department.

J. F. Blackwell, assistant manager of operations for The Texas Co.'s foreign operations department, producing division, has been transferred to New York from Caracas, Venezuela. Blackwell has been in Caracas since 1954. He has been with Texaco since 1936.

Henry H. Fuqua has been appointed Kansas district geologist of Vickers Petroleum Co. **Dwight S. Ramsey** has been named Panhandle district geologist for the same company. Fuqua was formerly with Sinclair Oil & Gas Co. and Ramsey was with Stanolind Oil & Gas Co.

Bob Johnston, district geologist for Western Gulf Oil Co. in Bakersfield, Calif., has been promoted to division geologist in Los Angeles. He succeeds **M. J. Hill,** who has been appointed director of geological research for Gulf Research & Development Co., Harmarville, Pa. **Iliff Anderson** will replace Johnston in Bakersfield.

Douglas E. Edwards, junior petroleum engineer with Sinclair Oil & Gas Co., has been transferred from Dickinson, Tex., to Silsbee, Tex. **William L. Brown,** assistant production foreman at Columbus, Tex., has been transferred to Dickinson. **Lloyd E. Browning,** district production foreman at Silsbee, Tex., will move to Columbus.

D. A. North, senior petroleum engineer in Humble Oil & Refining Co.'s Houston office petroleum engineering division, has been transferred to the Hobbs, N. M., district as district petroleum engineer. **R. M. Hunt,** petroleum engineer for the Houston office petroleum engineering division, has been transferred to the Gulf Coast division office, also in Houston. Joining the Houston petroleum engineering division will be **Charles B. Corley, Jr.,** senior petroleum engineer in the East Texas division, Tyler, Tex., and **A. E. Joens,** district petroleum engineer in the Tomball, Tex., district. Both will be senior petroleum engineers in Houston. **V. L. Garlington,** district civil engineer of the company's North Crowley, La., district, has joined the civil engineering division in Houston as supervising civil engineer.

Frank R. Lovering has been named division manager of Shell Oil Co.'s new Midland, Tex., production division.

David W. Young has been named research associate for Sinclair Research Laboratories, Inc., Harvey, Ill. A graduate of the University of Kentucky, Young was with General Chemical Co. and Esso Research & Engineering Co. before joining Sinclair in 1955. He holds 150 patents in the fields of oil and petrochemicals.

John Traut, geologist for Ohio Oil Co., has been transferred to Guatemala from the company's Bismarck, N. D., office.

Ralph Hamilton has been named assistant manager of Wrico Drilling Co. and Crest Petroleum Co., Wichita. Hamilton was formerly with Mountain Iron & Supply Co. and Sinclair Oil & Gas Co.

P. W. Judah, manager of the lubricating department for Socony Mobil Oil Co., has been appointed manager of the company's new petroleum chemicals department. Judah has been with Socony since 1932.

Glenn W. Stilley, assistant district production foreman for Sinclair Oil & Gas Co. in Stafford, Kans., has been transferred to Carmi, Ill. **William M. Cain,** assistant district production foreman at Carmi, will move to Stafford.

L. G. Jefferson, assistant manager of Signal Oil Co.'s southern district, has been appointed manager. He succeeds **E. F. Steen,** who has retired. **N. L. Yuille,** assistant manager of the company's northwest district, will replace Jefferson as assistant manager in the southern district.

J. Harry Wood, Jr., vice president of Atlantic Pipe Line Co., Dallas, has been elected president of the Pipe Liners Club. He succeeds **J. L. Burke,** president of Service Pipe Line Co., Tulsa. **Ralph K. Paine,** manager of the pipeline department of Standard Oil Co. of California, San Francisco, was elected vice president, and **Oliver C. Klinger,** of Pipe Line News, secretary. The board of governors includes Wood; Paine; **J. M. Linehan,** president of Mid-Continent Pipe Line Co., Tulsa; **Harry Moreland,** president of Great Lakes Pipe Line Co., Kansas City; and **O. Q. Lomax,** president of Humble Pipe Line Co., Houston.

V. E. Briard, staff geologist for Sohio Petroleum Co., has been transferred to the Gulf Coast division from the company's Oklahoma City offices.

M. R. Shaffer, formerly vice president and manager of Frankfort Oil Co. in Bartlesville, Okla., has formed Petrotrust Co. there.

Charles F. Manlove has been appointed geologist in charge of the Amarillo, Tex., office of Great Basin Petroleum Co.

Chester F. Smith, formerly a vice president, director, and member of the executive committee of Standard Oil Co. (N. J.), has been named a director of Daystrom, Inc., Elizabeth, N. J.

H. D. Beckwith has formed H. D. Beckwith Oil, Inc., in Wichita for operation in the Kansas and Oklahoma areas.

W. H. Mack, district geologist for Magnolia Petroleum Co. in Abilene, Tex., has been transferred to Shreveport, La., in the same capacity. **Richard R. Church** of the company's Dallas office, has been promoted to district geologist in Abilene replacing Mack.

Personals

Gerald Grimes has been transferred by Union Oil Co. from Coalinga, Calif., to Bakersfield, Calif., as drilling foreman.

Robert Meiklejohn, Jr., Westfield, N. J., has been named assistant to Tidewater Oil Co.'s eastern division transportation manager. Meiklejohn was formerly with M. W. Kellogg Co.

Dr. William A. Pardee, chemical engineer for Gulf Research & Development Co., Pittsburgh, has received the Scroll of Honor of the American Chemical Society's industrial and engineering chemistry division. The award recognizes service to the society.

Myron Hubley of Stanolind Oil & Gas Co., Casper, Wyo., has been elected president of the Wyoming Geological Association. Other officers are **Phil Andrews,** first vice president, Mobil Producing Co.; **Robert Jones,** second vice president, Schlumberger Well Surveying Co.; **Mary G. Clark,** secretary, Shell Oil Co.; and **Vince White,** treasurer, Gulf Oil Corp.

DEATHS

Robert W. Lea, 70, retired president of Johns-Manville Corp., died November 13 in New York. Lea became director and adviser to Olin Industries, Inc., after his retirement from Johns-Manville in 1951. He continued as a consultant to Olin Mathieson Chemical Corp. after retiring as a director of Olin Industries. He was formerly a director of numerous companies including Olin Oil & Gas Corp.

Chester H. Westfall, 64, president of the Chester H. Westfall Drilling Co., Tulsa, died November 12 in Tulsa after a heart attack. Westfall was president of Mercury Drilling Co. before forming his own company 3 years ago. He was formerly president of the old Marland Oil Co. of Mexico.

Neil Thomas Breaux, inventor of the Wilson hook-wall packers, died recently in Tomball, Tex., after a brief illness. Breaux had been with Wilson Supply Co. in Houston since 1946.

W. M. Vickery, 82, director of Blackwell Oil & Gas Co., Blackwell, Okla., died November 13 of cancer. Vickery was the father of **L. W. Vickery,** manager of engineers for Continental Oil Co. in Ponca City, Okla., and **Ward Vickery,** president of Vernon Oil & Gas Co., Wichita.

Bobby Manziel, 59, East Texas independent oil man, died November 9 in Tyler, Tex., after a sudden illness. One of East Texas' most successful wildcatters, Manziel named his new fields after his children. A sports enthusiast, he was once a sparring partner of Jack Dempsey and had recently entered into a construction partnership with Dempsey to build a huge sports arena near Tyler.

Russell S. Williams, 58, president of Gaseteria, Inc., was killed November 8 when his plane struck the radio tower of station WOR at North Bergen, N.J. Williams was a past president of the Indiana Independent Petroleum Association and served on the National Petroleum Council.

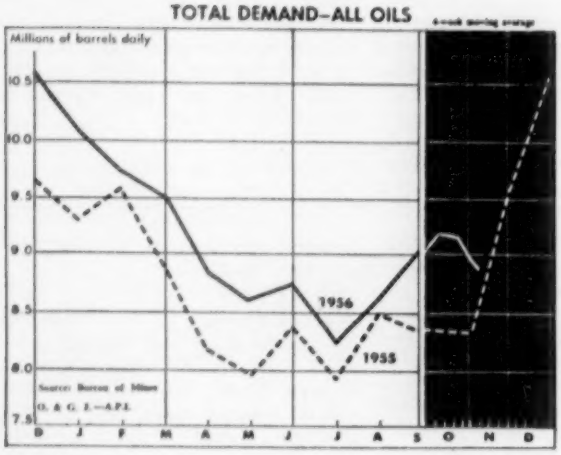
Carl V. Esterholt, 54, foreman for Mobil Producing Co. at Byron, Wyo., died early this month after a heart attack.

LeRoy Brown, 57, president and owner of Oil Well Cementing Co., Downey, Calif., died recently in Lynwood, Calif.

Latest Figures . . . Industry Trends

A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,074,500	UP	70,200	UP	90,983
Crude stocks	282,831,000	DOWN	777,000	UP	26,146
Completions	1,096	UP	40	DOWN	86
Refinery runs	7,964,000	UP	111,000	UP	411,000
Gasoline stocks	171,843,000	DOWN	783,000	UP	19,759,000
Kerosine stocks	36,105,000	UP	870,000	UP	343,000
Distillate stocks	161,656,000	UP	2,971,000	UP	11,050,000
Residual stocks	47,425,000	DOWN	646,000	UP	1,664,000
Four-product stocks	417,029,000	UP	2,412,000	UP	32,816,000
Total imports	1,219,500	DOWN	257,200	UP	87,100



Well Completions Headed for 58,600; Gulf Coast Fuel Prices Rise

REPORTS of well completions so far in the last half of the year indicate a smaller loss in drilling from the steel shortage than was expected at midyear.

In any normal postwar year, total completions for the last 6 months have exceeded those in the first half. Part of this increase has been due to 3 extra days in the last half, but the gain shows up even on a daily average basis.

For the 5-year period 1951-55, daily completions for the last halves of the years averaged about 5.7 per cent more than for the first halves. First-half average for the 5-year period was 133.2 wells per day compared with a last-half average of 140.8 wells. This gain was recorded despite the decreased drilling in the last half of 1952 following the steel strike of that year.

Earlier forecasts of drilling for the last half of this year assumed a loss in drilling due to the shortage of steel but not enough to drop the last-half total below reported completions for the first 6 months.

From the end of June through November 10, completions have averaged 163.1 wells per day compared with 158.4 wells per day in the first half. This average represents a gain of 3.0 per cent over the first half of this year compared with the 5-year average gain of 5.7 per cent.

Current trends in drilling, shown by weekly reports, point to a total of about 58,600 wells for the year, up about 1,900 wells over 1955. This will be the smallest gain since 1952 when lack of steel prevented normal drilling.

An important factor in drilling this year is the fact that the only big gain on a state-wide basis has been in Texas. Completions in Texas through November 10 amounted to 18,996 wells compared with 17,336 through November 10 last year. This increase of 1,660 is larger than the gain of 1,150 wells for the whole country.

The greatest increase in number of wells by districts has been in West Texas, but the largest percentage gain has been in the Panhandle.

The most important downward shift in the last half is reported for Oklahoma. Total completions in this state during the first half topped the same period of the previous year by 48 wells. Since midyear, completions have dropped 224 wells below the number reported for the same period last year.

In making comparisons from the cumulative columns of the weekly report, some consideration should be given to the fact that the 1955 period contains 1 day more than the reported period for 1956.

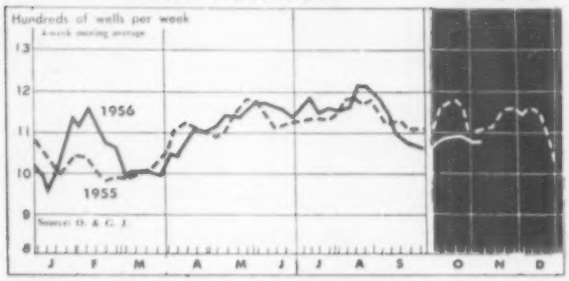
Gulf Coast markets firm—except gasoline . . . Expected calls from European marketers for light and heavy fuels are the basis for the firming trend on the Gulf Coast.

Earlier in the week, Bunker C fuel moved up about 10 cents a barrel, followed by other quotations that have placed the low of the market at about $2.35. Low-sulfur material, under 1 per cent, is quoted at $2.55.

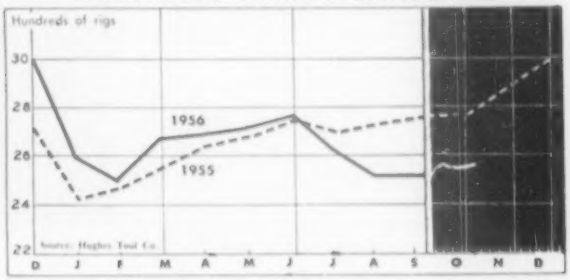
Very little spot No. 2 fuel is available on the Gulf Coast, but a good gasoline customer probably could find a cargo for immediate lifting.

Higher residual prices are reported on the East Coast.

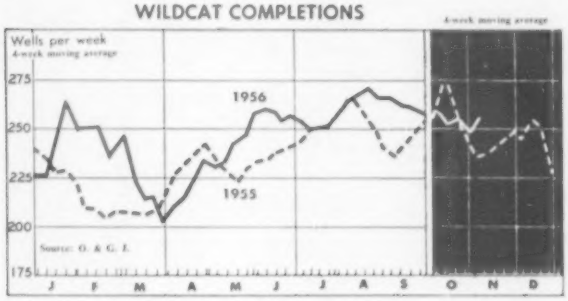
TOTAL COMPLETIONS



ROTARY RIGS OPERATING IN UNITED STATES



WILDCAT COMPLETIONS



ACTIVE ROTARY RIGS*

Area—	11-12-56	11-5-56	11-14-55
North Central and East	112	117	136
Southeast	38	41	41
Okla., Kans., Ark., Mo.	440	444	562
Louisiana	456	453	419
North and East Texas-Panhandle	383	384	419
Gulf and South Texas	250	235	247
West Texas-New Mexico	513	512	586
Rocky Mountain	252	243	294
Pacific Coast	114	113	145
Total United States	2,558	2,542	2,849
Western Canada	252	252	199

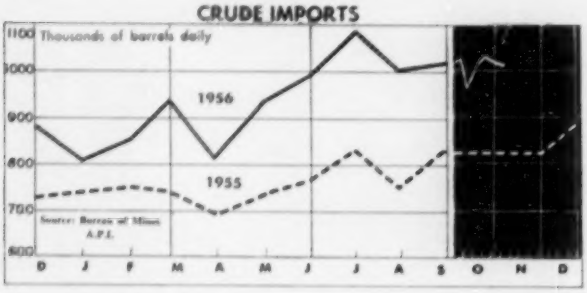
*Hughes Tool Co.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED NOVEMBER 10, 1956

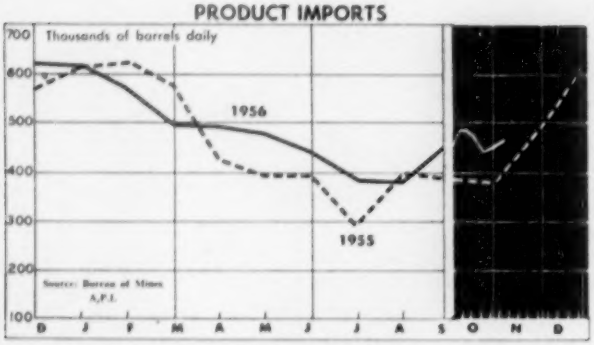
	Total of all wells					Cum.		Wildcat completions and discoveries					Cumulative total, 1956				
	Comp.	Oil	Gas	Dry	Footage	1956	1955	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
Ala.-Ga.-Fla.	3	1	0	2	26,425	98	66	0	0	0	2	2	0	0	1	43	44
Arkansas	22	17	0	5	67,537	816	702	1	0	0	3	4	31	0	7	126	164
California	43	34	0	9	186,863	1,902	2,103	1	0	0	8	9	46	0	9	387	442
Colorado	31	4	5	22	147,575	1,047	1,295	0	0	1	19	20	24	0	15	526	565
Illinois	83	30	2	51	170,203	3,403	3,369	2	0	1	21	24	45	0	4	616	665
Indiana	19	9	0	10	30,594	605	624	0	0	0	2	2	16	0	1	105	122
Kansas	92	42	7	†43	323,810	4,297	4,342	3	0	3	18	24	110	4	38	786	938
Kentucky	34	21	0	13	41,033	1,637	1,376	0	0	0	3	3	36	0	1	339	376
Louisiana	59	28	6	25	489,005	3,265	3,475	3	0	0	8	11	103	48	52	455	658
North	25	12	2	11	118,050	1,441	1,790	3	0	0	6	9	31	2	3	192	228
South	27	14	2	11	300,685	1,477	1,685	0	0	0	2	2	58	40	36	232	366
Offshore	7	2	2	3	70,270	347		0	0	0	0	0	14	6	13	31	64
Michigan	5	4	0	1	18,057	380	458	0	0	0	1	1	9	0	2	134	145
Mississippi	7	0	0	7	46,242	381	397	0	0	0	5	5	15	1	1	170	187
Montana	7	2	0	5	43,205	401	344	0	0	0	3	3	11	0	1	139	151
Nebraska	12	6	0	6	71,788	822	768	2	0	0	4	6	35	0	1	373	409
New Mexico	44	18	17	9	160,119	1,660	1,478	1	0	0	7	8	46	1	9	181	237
Northwest	29	9	16	4	113,033	743	509	1	0	0	4	5	12	0	7	66	85
Southeast	15	9	1	5	47,086	917	969	0	0	0	3	3	34	1	2	115	152
North Dakota	7	5	0	2	44,034	232	225	0	0	0	1	1	8	0	0	60	68
Ohio	27	15	7	‡5	68,076	934	1,049	0	0	0	0	0	2	0	4	6	12
Oklahoma	148	85	7	§56	499,348	7,142	7,377	2	0	0	11	13	111	18	34	592	755
Pennsylvania-New York	2	0	2	0	6,904	959	1,311	0	0	0	0	0	0	0	13	17	30
Texas	405	218	20	167	1,727,506	18,996	17,450	11	0	5	91	107	655	31	170	3,996	4,852
Southwest (1 & 4)	57	23	2	32	225,500	2,715	2,697	1	0	1	22	24	118	6	60	765	949
Gulf Coast (2 & 3)	52	17	13	22	330,888	2,267	2,193	1	0	4	13	18	60	16	61	610	747
East (5 & 6)	25	11	1	13	150,565	1,001	842	0	0	0	8	8	14	2	6	340	362
N. Central (7-B & 9)	140	77	1	62	386,744	6,774	6,489	6	0	0	26	32	287	0	11	1,582	1,880
West (7-C & 8)	109	79	0	30	551,365	5,095	4,309	3	0	0	16	19	158	0	11	634	803
Panhandle (10)	22	11	3	8	82,444	1,144	920	0	0	0	6	6	18	7	21	65	111
Utah	15	4	2	9	68,089	120	79	3	0	1	8	12	9	0	5	61	75
West Virginia	14	1	11	2	39,436	596	567	0	0	0	0	0	0	0	11	9	20
Wyoming	17	6	1	10	67,691	767	788	1	0	0	6	7	16	0	10	211	237
Miscellaneous	0	0	0	0	0	71	58	0	0	0	0	0	4	0	0	60	64
Total U. S.	1,096	550	87	459	4,343,540	*50,531	49,701	30	0	11	221	262	1,332	103	389	9,392	11,216
Total previous week	1,056	568	94	394	4,248,587			38	1	11	183	233	1,302	103	378	9,171	10,954
Total Nov. 12, 1955	1,182	650	91	441	4,673,990			35	5	5	214	259	1,416	188	301	8,758	10,663
Cumulative 1956*	50,531	27,104	3,546	19,881	202,667,187												
Western Canada	99	66	7	26	442,166	2,772											

Service wells included: †1, 12, §7. *Revised.

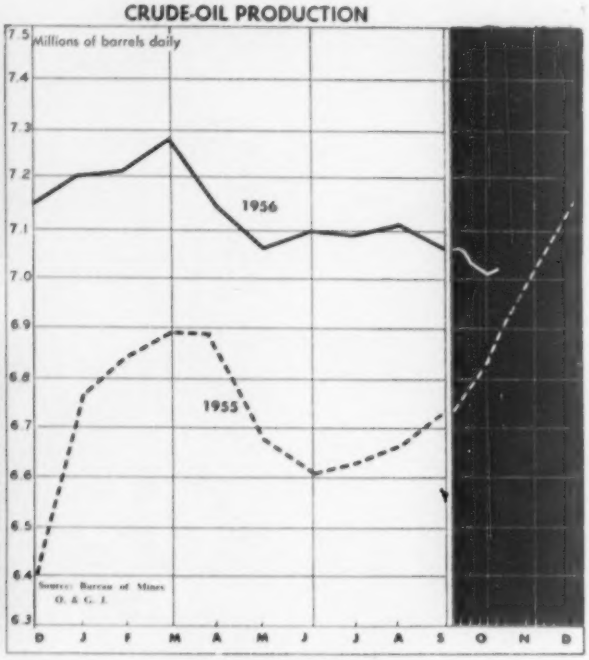
CRUDE IMPORTS



PRODUCT IMPORTS



CRUDE-OIL PRODUCTION



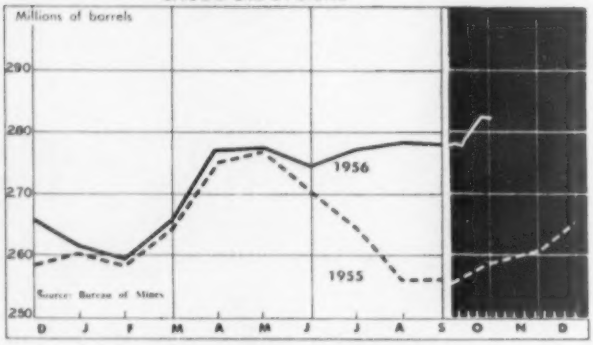
DAILY AVERAGE PRODUCTION FOR WEEK

	November 10, 1956			Nov. 3
	Crude oil	Lease condensate	Total	total
Alabama	11,300		11,300	11,200
Arkansas	77,850	350	78,200	78,100
California	953,400		953,400	957,100
Colorado	155,300		155,300	160,900
Eastern	50,100		50,100	50,400
Florida	1,275		1,275	1,275
Illinois	237,800		237,800	236,800
Indiana	32,000		32,000	32,000
Kansas	320,900		320,900	327,900
Kentucky	48,900		48,900	49,100
Louisiana	730,450	66,200	796,650	796,750
North	117,100	2,200	119,300	119,400
South	613,350	64,000	677,350	677,350
Michigan	26,600		26,600	26,400
Mississippi	108,950	5,000	113,950	113,950
Montana	59,000		59,000	61,400
Nebraska	39,000		39,000	37,900
Nevada	200		200	200
New Mexico	246,025	4,200	250,225	250,225
North Dakota	36,100		36,100	35,200
Oklahoma	†555,100		†555,100	†529,900
Texas	2,951,600	54,500	3,006,100	2,952,100
Dist. 1	57,000	550	57,550	56,825
Dist. 2	145,000	8,600	153,600	150,750
Dist. 3	417,000	26,000	443,000	438,000
Dist. 4	226,000	6,500	232,500	233,225
Dist. 5	39,000	450	39,450	40,875
Dist. 6	124,000	6,000	130,000	127,850
East Texas field	202,600		202,600	197,875
Dist. 7-B	155,000	45	155,045	157,195
Dist. 7-C	172,000	3,905	175,905	174,480
Dist. 8	1,099,000	1,600	1,100,600	1,060,600
Dist. 9	210,000	650	210,650	211,375
Dist. 10	105,000	200	105,200	103,050
Utah	7,600		7,600	7,800
Wyoming	294,700		294,700	287,600
Others	‡100		‡100	‡100
Total U. S.	6,944,250	130,250	7,074,500	7,004,300
Change from previous week, up			70,200	
Canada	†451,300		†451,300	†439,400

Total U. S. production—January 1-November 10 . . 2,244,602,450 bbl.
Same period last year (crude plus cond.) . . . . . *2,122,568,050 bbl.

*Includes 35,377,850 bbl. condensate. †Week ended previous Monday. ‡South Dakota.

CRUDE-OIL STOCKS



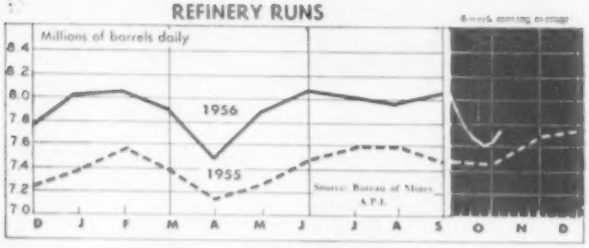
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

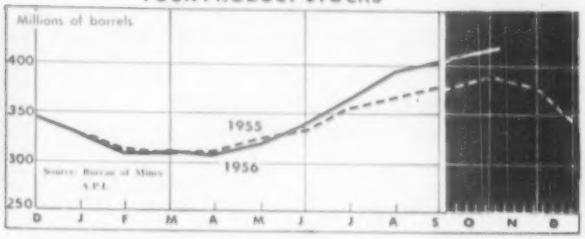
	11-3-56	10-27-56	11-5-55
Pennsylvania Grade	2,451	2,449	3,147
Other Appalachian	2,426	2,311	1,765
Illinois, Indiana, Michigan	11,786	11,143	9,147
Nebraska, North Dakota	2,157	2,311	2,350
Kansas	10,491	10,470	8,108
Oklahoma	24,594	25,162	20,781
Arkansas	3,092	2,934	2,472
Louisiana	18,300	17,397	15,813
North	2,758	2,734	3,018
South	15,542	14,663	12,795
Mississippi	3,127	3,010	3,127
New Mexico	9,218	9,155	7,289
Texas	126,522	128,303	122,281
East Texas proper	8,698	9,231	9,023
West Texas	61,161	63,219	57,261
Texas Gulf	24,413	23,976	25,352
Other Texas	32,250	31,877	30,645
Wyoming	17,468	16,890	14,661
Other Rocky Mountain	6,235	6,475	5,843
California	29,413	29,453	27,290
Foreign	†15,551	16,145	12,611
Total	282,831	283,608	256,685

*Bureau of Mines. †Includes 4,141,000 bbl. in California.

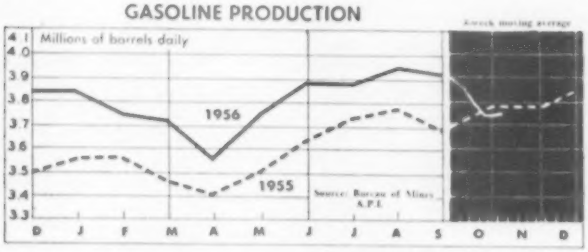
REFINERY RUNS



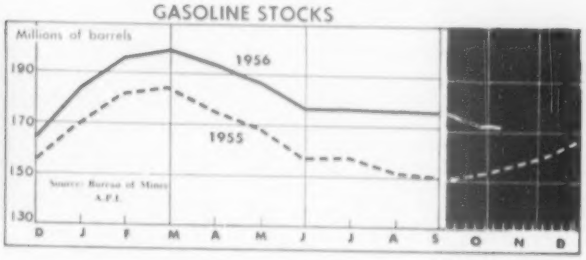
FOUR-PRODUCT STOCKS



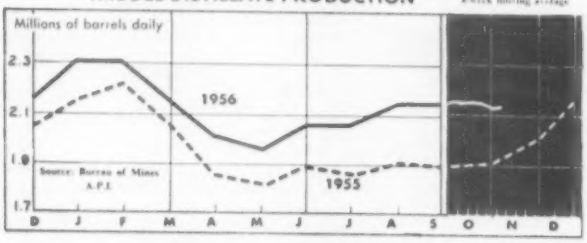
GASOLINE PRODUCTION



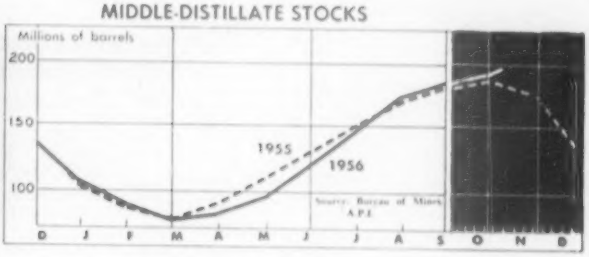
GASOLINE STOCKS



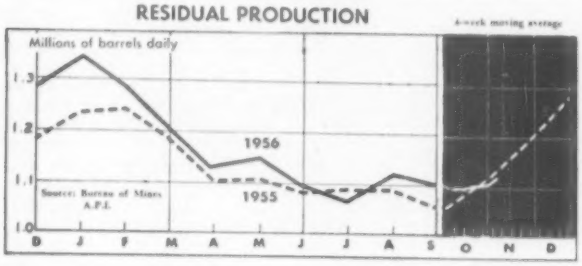
MIDDLE-DISTILLATE PRODUCTION



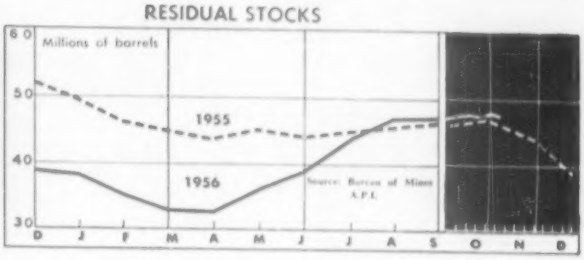
MIDDLE-DISTILLATE STOCKS



RESIDUAL PRODUCTION



RESIDUAL STOCKS



A.P.I. REFINERY REPORT, NOVEMBER 9, 1956

(Thousands of barrels)

District—	Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.	Stocks‡—Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, November 1955—Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.
East Coast	1,164	424.0	34.9	276.0	214.0	41,110	14,305	62,523	12,436	1,102	428.0	27.6	267.4	222.9
Appalachian:														
District 1	102	40.6	5.9	28.0	8.1	4,366	702	3,732	460	112	46.1	5.5	21.1	8.2
District 2	99	46.9	6.0	15.1	10.0	2,632	766	1,051	271	91	50.7	3.8	18.1	12.5
Ind., Ill., Ky.	1,370	734.0	77.1	278.0	166.3	29,274	7,923	25,481	6,112	1,375	751.2	73.3	272.1	192.8
Minn., Wis., Dak.	97	47.0	7.4	25.7	7.1	6,818	1,783	8,790	121	(§)	(§)	(§)	(§)	(§)
Okla., Kans., Mo.	676	342.1	26.3	148.9	30.9	14,415	1,891	14,117	1,544	693	406.2	17.8	162.9	34.9
Inland Texas	261	197.0	4.0	50.0	19.0	7,251	602	2,167	1,851	251	186.8	9.8	47.2	19.0
Texas Gulf Coast	1,926	941.7	141.7	502.6	266.0	24,942	3,910	16,177	7,021	1,940	907.8	137.3	481.2	255.1
La. Gulf Coast	685	354.0	68.3	153.3	59.0	10,636	2,416	7,821	1,623	688	357.8	54.8	165.3	48.1
N. La. and Ark.	103	38.7	10.7	20.0	6.6	3,809	1,039	2,345	294	97	36.7	6.4	24.9	6.7
Rocky Mountain:														
New Mexico	23	12.3	0.6	4.4	4.0	505	11	175	45	22	11.0	0.4	3.9	2.6
Other Rocky Mtn.	266	128.6	3.4	57.7	38.7	4,690	410	3,212	970	256	122.8	4.3	62.0	42.3
West Coast	1,192	509.4		195.9	352.4	21,395	347	14,065	14,677	1,065	482.7		153.7	368.6
Nov. 9, 1956	7,964	3,816.3	386.3	1,755.6	1,182.1	171,843	36,105	161,656	47,425	7,692	3,787.8	341.0	1,679.8	1,213.7
Nov. 2, 1956	7,853	3,802.9	358.1	1,782.4	1,119.3	172,626	35,235	158,685	48,071					
Nov. 11, 1955	7,553	3,686.6	325.4	1,584.4	1,117.9	152,084	35,762	150,606	45,761					

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines. §Included in Indiana, Illinois, Kentucky district.

Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
Regular (88 octane)	11.00-11.50
Premium (96 octane)	12.75-13.25
Gulf Coast (cargoes for coastwise or export movement):	
Regular (90 octane)	11.00-11.50
Regular (92 octane)	11.25-11.75
Premium (97 octane)	12.75-13.25
Premium (98 octane)	13.00-13.50
California—Los Angeles (rack):	
Regular (84 octane)	12.1-12.6
Premium (93 octane)	13.35
Premium (96 octane)	14.3-14.6
Caribbean area (cargoes):	
Regular (87 octane)	10.00
Premium (93 octane)	11.50

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:	
Grade 26-70	4.5
Breckenridge:	
Grade 26-70	4.0

*If 26-70 natural is considered as 100 per cent, prices for lower-vapor-pressure grades increase 2.5 per cent for each unit drop in Reid vapor pressure down to and including 16-lb. Prices for grades below 16-lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
Kerosine 42-44	9.75-10.00
Diesel oil (58 d.i. and above)	9.50-9.75
Distillate No. 1	9.375-9.625
Distillate No. 2	8.75-9.00
Gulf Coast (cargoes):	
Kerosine 41-43	9.5
Distillate No. 2	9.0
New York Harbor (barges):	
Kerosine 41-43	11.25
Distillate No. 2	10.65
Diesel fuel, 48-52 d.i.	10.95
Caribbean area (cargoes):	
Distillate No. 2	9.0

WAX (LB.)

Oklahoma (Group 3):	
132-135 A.m.p. (semi-refined) in tank cars	6.50
New York (export):	
126-130 A.m.p. crude scale (solid in bags or barrels)	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$2.05-2.10
Gulf Coast (cargoes):	
★ Bunker C fuel	$2.35
New York Harbor (barges):	
★ Bunker C fuel	$3.05
Caribbean (cargoes):	
★ Bunker C at Aruba, N.W.I.	$2.25
California (rack):	
Bunker C fuel, Los Angeles	$2.15-2.25

LUBRICATING OILS

Mid-Continent (Group 3):	
150-160 bright stock, solvent refined, 0-10 p.p., 95 v.i.	24
200 vis. neutral oil, solvent refined, 0-10 p.p., 95 v.i.	20.75
Pennsylvania Grade:	
145-155 vis. at 210, bright stock, 8 color, 25 p.t.	27
200 vis. neutral (180 at 100°), 25 p.t.	25

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Mid-Cont.*	Gulf Coast Tex.†	West Tex.‡ N.M.	Wyo. (sour)
14-14.9	$2.02	....	....	....	....
15-15.9	2.08	....	....	....	....
16-16.9	2.13	....	....	....	....
17-17.9	2.19	....	....	....	....
18-18.9	2.24	....	....	....	....
19-19.9	2.30	....	....	....	....
20-20.9	2.35	$2.50	....	$2.37	....
21-21.9	2.41	2.52	....	2.39	....
22-22.9	2.47	2.54	....	2.41	....
23-23.9	2.52	2.56	....	2.43	....
24-24.9	2.58	2.58	$3.01	2.45	....
25-25.9	2.64	2.60	3.03	2.47	$2.13
26-26.9	2.69	2.62	3.05	2.49	2.19
27-27.9	2.76	2.64	3.07	2.51	2.24
28-28.9	2.83	2.66	3.09	2.53	2.29
29-29.9	2.91	2.68	3.11	2.55	2.34
30-30.9	2.97	2.70	3.13	2.57	2.39
31-31.9	3.04	2.72	....	2.59	2.44
32-32.9	3.12	2.74	....	2.61	2.48
33-33.9	3.20	2.76	....	2.63	2.52
34-34.9	3.27	2.78	....	2.65	2.56
35-35.9	3.34	2.80	....	2.67	2.60
36-36.9	3.39	2.82	....	2.69	2.64
37-37.9	....	2.84	....	2.71	2.66
38-38.9	....	2.86	....	2.73	2.68
39-39.9	....	2.88	....	2.75	2.70
40 and up	....	2.90	....	2.77	2.72

*Includes Oklahoma, Kansas, North Dakota, West Texas (sweet), North Central Texas, North Louisiana, Arkansas. †Low-cold-test Gulf Coast. ‡Sour.

Effective dates: California, February 7, 1956; east of California, June 15, 1953; Pennsylvania Grade, August 16, 1956.

Some crudes in North Central Texas, West Central Texas, and Texas Panhandle have been shifted to the intermediate schedule with $2.83 for 40° and 2 cents per degree drop. Effective dates range from July 15, 1956, to August 10, 1956.

FLAT PRICES

Louisiana:	
Cotton Valley (distillate)	$3.00
Cotton Valley (Holloway crude)	2.95
Texas:	
East Texas	2.90
Chapel Hill	2.83
Conroe	3.13
Van	2.73
Pennsylvania Grade:	
Bradford	4.68
Middle District	4.50
Southwest Pennsylvania	4.21
West Virginia	4.03
Buckeye Grade	4.07
Zanesville Grade	3.15
Illinois Basin	2.90
Canada:	
Leduc-Woodbend (flat prices D-2, D-3)	2.60
Redwater (Alta.) D-3	2.49
Smiley-Viking (Sask.)	2.26
Fosterton (Sask.)	1.29
Pembina	2.52

FOREIGN

Venezuela:	
Cumarebo, 48°-49.8°, Tucupido	*$3.40
San Joaquin, 41°-41.9°, Puerto La Cruz	*3.04
Oficina, 35°-35.9°, Puerto La Cruz	$2.80
Tia Juana medium, 26.5°-26.9°, Amuay§	†2.30
Quiriquire, 16.5°-16.9°, Caripito	‡2.21
Lagunillas heavy, flat, Amuay or Las Piedras§	2.05
Bachaquero, 16.5°-16.9°, Amuay or Las Piedras§	‡1.90

*Plus or minus 2 cents per barrel for each degree gravity change. †Plus or minus 2.5 cents per barrel for each half-degree gravity change. ‡Plus or minus 3.5 cents per barrel for each half-degree gravity change. §Also available at La Salina at 3.0 cents per barrel less.

Middle East, Persian Gulf (cargoes, f.o.b. lifting port):	
Arabian, 36.0°-36.9°, Ras Tanura	$1.97
Iranian, 34.0°-34.9°, Bandar Mashur	1.91
Iranian, 34.0°-34.9°, Abadan	1.86
Iraq, 36.0°-36.9°, Fao	1.87
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.72
Qatar, 39.0°-39.9°, Umm Said	2.06
Middle East, E. Mediterranean:	
Arabian, 36.0°-36.9°, Sidon	2.46
Iraq, 36.0°-36.9°, Tripoli, Banias	2.46
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°-38°	2.60

TANKER RATES PER LONG TON

(Latest reported spot fixtures)

Gulf-U.S.N.H., clean (USMC+170%)	$7.70
Gulf-U.S.N.H., dirty (USMC +172.5%)	7.77
N.W.I.-U.S.N.H., dirty (USMC +165%)	7.16
★ Gulf-U.K., dirty (Scale+285%) (147s. 10d.)*	20.57
★ N.W.I.-U.S.N.H., dirty (Scale+245%) (58s. 4d.)*	8.12
★ P.G.-U.K., dirty (Scale+325%) (209s. 10d.)*	29.20

*Based on new scale rates.

Your MARKET PLACE FOR THE OIL AND GAS INDUSTRY...

CLASSIFIED ADVERTISING

UNDISPLAYED CLASSIFIED 26c a word one issue. 10% Discount three or more consecutive issues. $5.00 minimum charge. Blind Box in our care nine words. Payable in Advance.

DISPLAY CLASSIFIED
$18.00 a column inch one issue
10% Discount three or more consecutive issues.

Address Classified Advertising Material: The Oil and Gas Journal, P. O. Box 1260, Tulsa 1, Okla.

FOR SALE EQUIPMENT

BUCYRUS ERIE 36L with 70' tripod derrick, GK 145 Waukesha motor, casing line & blocks, and dog house. Unit is 18 months old. Stansylvania Oil & Gas Co. Box 311, Borger, Texas.

1 CARDWELL & 1 Brewster double drum spudder. 1 Wilson "senior" single drum pulling unit mounted on Dodge truck. Complete set of tools and accessories with each unit. Davon Oil & Gas Co., Box 1586, Oklahoma City.

FOR SALE: 2 OCT Series 900, 6" pack-off type BOP, complete with 2" and 2½" pack-off elements, and 2" and 2½" stripper rubbers. Price $500 each. Billings Oil Service, P. O. Box 1562, Corpus Christi, Texas, telephone TUlip 4-8711.

Stop Tong Breakage!

ARMITE DRILL COLLAR & TOOL JOINT COMPOUND

ARMITE LABS., 8609 Broad St., Los Angeles 1, Calif.
Petro. Industries Consultants, C.A. Caracas, Venez.

FOR SALE

OIL FIELD DRILLING ENGINES
L.R.O. Waukeshas
N.K.U. Waukeshas
E.K. Waukeshas
W.A.K. Waukeshas
X.A.H. Waukeshas
F.C.U. Waukeshas

With Twin Disc Clutches, Butane Equipment & Oil Field Skids. All Engines Carry New Engine Guarantee.

WALLACE ENGINE & SUPPLY
1915 S.E. 15th St. Phone ME 7-1988
Oklahoma City 9, Okla.

LIQUIDATING

PURE OIL REF., CHARLESTON, W. VA.
AND BAY REF., McPHERSON, KANSAS

TWO MODERN and COMPLETE REFINERIES

All equipment and machinery for sale at fraction of original cost.

WRITE FOR CATALOGUE

BROWN-STRAUSS CORPORATION

1548 Guinotte Ave., Kansas City, Mo.
Phone HA 1-1000

Field Office: Cabin Creek (suburb of Charleston, W. Va.)

Phone East Bank 5611, Roy Crisp, Mgr.
P. O. Box 2921, Charleston, W. Va.

FOR SALE EQUIPMENT

PRICED TO SELL. Hydraulic pipe pulling unit, two speed 6' jacks, spiders, slips, arch bars, sill, breakout tongs, 4 cylinder displacement pump etc. All on 47 2 Ton Dodge Truck. All in good shape and ready to work. Phone SH 6-4016, J. E. Bedingfield, Box 563, Artesia, New Mexico.

ONE R. L. CARDWELL RIG complete, now running. 5000' 3½" drill pipe & One 250 Emsco complete, just completed a well. Will sell either or both of these rigs to persons or firms with good record on monthly payments with little or no down payment. P. O. Drawer 1589, Lubbock, Texas.

STEEL PIPE & TUBING

• CHROME MOLY • CARBON MOLY
• MONEL • CARBON STEEL • STAINLESS

Widest Range of Sizes & Specs in the U. S.
WRITE FOR STOCK LIST

MIDCONTINENT TUBE SERVICE, INC.
2308 Oakton St., Evanston, Ill. OA 8-4030

FOR SALE EQUIPMENT

FOR SALE at Oil Hill, Kansas, 1—3½" x 7" Aldrich Vertical Triplex Pump, Serial #15579, suitable for water flood work. Price $1500.00. Cities Service Oil Company—Patridge—Bartlesville.

GAS METERS FOR SALE: Foxboro and Westcott Orifice Meters, Late Type. Good Condition. George Milner, Box 124, Okmulgee, Okla.

BUCYRUS ERIE 36L with Standard mast reinforced, GK 145 Waukesha motor, Casing line & Blocks, and dog house. Stansylvania Oil & Gas Co. Box 311, Borger, Texas.

Gaso Duplex 4½" x 6" Power Pumps with Chrysler C-36 Engines, skid mounted, immediate delivery. Also Byron Jackson, Carter Centrifugal Units. Westinghouse 20-25-50 KW Generating Units.

H. H. COFFIELD
Attn.: W. H. ORR
Phones: 132—Rockdale, Texas
AT-3427—Houston, Texas

LIQUIDATION!

NEAR LONGVIEW, TEXAS

COMPLETE POLY UNIT, BUILT 1950 UOP RATED 144 BBL./DAY

1—Wyatt 30" x 70' Stabilizer 160# 30 tray
6—Brown fintube exchangers, 300# 140 sq. ft. 4-6 chrome.
1—5' x 90' tower, 40 tray, 135# WP
1—6' x 34' Vacuum tower, 150#.
1—2' x 50' tower, 24 trays.
5—Welded tanks, 10' x 40', 10' x 30', 9' x 20'.
1—Ethyl lead plant.
3—Convection furnaces, 20 MIL. BTU/hr
12—Welded storage tanks, 5,000, 2,000 1,000 bbl.
8—Hi-vol pumps, 10 x 7 x 18 10 x 6 x 12 6 x 4 x 12, 6 x 3 x 8.
4—Steel Bldgs., 20 x 20, 20 x 40.
2—8½" x 25' Tanks 50#.
1—BS&B O&G separator, 10.7 mcf/day
Large Selection of Series 15, 30 Steel Valves. 1" to 8".
Approximately 15,000 ft. Schedule 40, 80 pipe, 2" to 8".

HOT-OIL PUMPS

3 Pacific ITB, 400 gpm—2,000' hd, 735 gpm—3,100' hd.
3 Pacific SVTB, 612 gpm—600' hd, 324 gpm—400' hd, 308 gpm—516' hd, 193 gpm—389' hd.
1 Pacific HVTB (unused) 1270 GPM—400' HD.

IN STOCK

HEAT EXCHANGERS

10—Kellogg Adm. Fltg. Hd. 2700, 2200, 1800 Sq. Ft.
6—Kellogg Steel Fltg. Hd. 1500, 800, 500 Sq. Ft.

COMPRESSORS

1 Worth LTC-6 800 hp
2 Clark RA-5 500 hp.
1 Worth LTC-3 400 hp.
3 Penn Comps 100 CFM 500 lbs.
385 CFM 160 lbs.

MISCELLANEOUS

6—Bird Centrifugals 32 x 50, 24 x 38, 18 x 28.
5—Sweetland Filters No. 12, No. 16, No 7, No. 5
4—Rotary Vac. Filters, 10 x 12, 8 x 10, 5 x 8.
6—Adm. 785, 742, 425 sq. ft. ht. exch.
30—304 SS shell & tube condensers 100-1000 sq. ft.
Lab Petro-Chem furnace 50,000 BTU/hr
9—3' x 10' 410 SS Sheets.
Tremendous selection stainless steel and steel valves ½"-6".
BJ hot oil pump 3 x 9, 13 st, 325 gpm 4600' hd.
Goulds 16" pump, 10500 gpm, 135' hd.

PARTIAL LIST ONLY

WIRE! PHONE! WRITE!
FOR DETAILED CIRCULAR

BRILL EQUIPMENT COMPANY

4101 San Jacinto St., Houston 4, Texas, JA 6-1351
or
2401 Third Ave., New York 51, N. Y., CYpress 2-5703

FOR SALE EQUIPMENT

WILSON SPUDDER complete with double pole mast, all tools, 145 GK Waukesha power, dog house, light plant. 145 GK Waukesha Engine less clutch. Four years old. Very good condition. Buda, Diesel Rig-Lighting 6KW D.C. Plant with skid pickup, completely rebuilt in our shop. Mead Engine & Welding Works, Box 395, Sterling, Kansas.

FOR SALE EQUIPMENT

80 DRILL COLLARS, Sonoscoped 3½", 4" and 4½" Drill Pipe. Don Harman Pipe & Supply. ME 7-4343, Okla. City, Okla.

CORE DRILLS, SPUDDERS, ROTARIES. New and used equipment. Everything in supplies. Fishing tools rented. Pressey & Son, Pueblo, Colo.

FOR SALE EQUIPMENT

FAILING 1500 heavy duty rig complete ready for operation. Excellent condition. Ted Wells, 6427 East Kellogg, Wichita, Kansas.

TWO 400 H.P. RA-4 Clark angle gas compressors, now running, auxiliary equipment and spare parts. Units less than seven years old. Alfred B. Kern, 305 Kennedy Bldg., Tulsa, Oklahoma.

SEISMOGRAPH Recording Equipment: For Sale or long term lease to responsible party for one or more 24 trace SIE recording units, excellent condition with or without cabs and/or trucks. Box J-791, The Oil and Gas Journal, Tulsa, Oklahoma.

IMMEDIATE DELIVERY: 5060 feet; 5½" OD grade J-55 8-RT Spang smls casing; 6500 feet; 2⅜" OD grade J-55 8-RT Spang smls EUE tubing. F.O.B. Sterling, Colo. Phone LA—2-3696, Sterling, Colo.

FORGED STEEL FLANGES. Reconditioned 2"-12" Series 15 and 30—Weld Neck, Slip On, Orifice, Threaded, Blind. Price List on request. Vol L. Boswell, 1003 Kennedy Building, Tulsa, Okla.

FOR SALE in Seminole field: 1—5000 barrel erected bolted steel tank—Price $1500.00. Cherokee Pipe Line—Patridge—Bartlesville.

3,652' 4½" O.D. converted drill pipe with J-55 couplings, 3,000# test; 3,378' 4½" O.D. 9½# J-55 new casing. Call LUther 4-0595 or write Rio Hondo Oil and Development Corp., 1122 Gaiennie Street, New Orleans, Louisiana.

SALES AND RENTALS. Used cable drilling and fishing tools, casing, production equipment; from the Southwest's largest stock of oil field supplies. Degen Pipe and Supply Co., Tulsa.

FOR SALE: 2—127' Lee C. Moore Cantilever Masts. One (1) mast with a 41'x9' substructure and one (1) Mast with 46'x9' substructure. Box J-799, The Oil and Gas Journal, Tulsa, Oklahoma.

127' TYPE B OIL WELL Jackknife Derrick with five-sheave crown, 10' x 42' x 24' Split Type Sub-Structure, steel flooring. Price, $7,500. IVERSON SUPPLY COMPANY, Kermit, Texas. Phone 3491.

CARDWELL MODEL "S", double drum with WAK Waukesha, 87 foot Moore mast, folding platform, substructure; Emsco 7½ x 14 pump with two WAK Waukesha; rotary, block, hook, kelly, swivel, BOP, light plants, tool house, bunk house, miscellaneous equipment. Box 3246, Corpus Christi, Texas.

FOR SALE: Rotary Drilling Equipment

Recently, The Republic Supply Company of California bought the entire equipment of one of California's largest drilling contractors. This equipment is now for sale. Write for complete details and prices.

DRILLING RIGS

Emsco J-1000, 142' L. C. Moore Mast, powered by three 12 cyl. Le Roi Engines, 230P Oilwell, FXQ Gardner-Denver Pumps.

Emsco A-800, 138' Ideco Full View Mast, Powered by four PTD-6 Superior Diesels, C250 and C350 National Pumps.

Emsco J-1000, 142' L. C. Moore Mast, powered by five 12 cyl. Le Roi Engines, GXR and FXQ Gardner-Denver Pumps.

National 50A, 126' L. C. Moore Mast, Powered by three WAK Waukesha Engines, FXQ Gardner-Denver, 14P-HD Oilwell Pumps.

National 50CA, 126' L. C. Moore Mast, powered by two GM Torque Converter Twins, 18P Oilwell, FXO Gardner-Denver Pumps.

National 110, 138' L. C. Moore Mast, powered by three PTD-6 Superior Diesels, D16 Emsco, FXK Gardner-Denver Pumps.

Above are complete drilling rigs with all equipment except drill pipe and blow out preventers. Complete inventories upon request.

MISCELLANEOUS EQUIPMENT

Crown Block, 6 Sheave, Emsco M-50 6 grooved 1⅛" line.

Traveling Block, Emsco NC-35 with Web Wilson 125 Ton Connector.

Compressor, Gardner-Denver ADR.

Drawworks, G-500 Emsco Double Drum with two LP600 Cummins Engines.

Engines, Hall Scott Model 357-O

Engines, Le Roi Model L-3000, (overhauled), less radiator and clutch.

Engines, Superior PTD-6 Diesel.

Generator, 15KW, 110/220 V Electric Machinery with 6 BZU Waukesha Gas Engines.

Hook, Regan Triplex, 200 Ton.

Indicator, Martin Decker Sealtite with Mud Gauge.

Pump, Emsco D16 7¼x16, powered by 2 Le Roi 12 cyl. Gas Engines

Pump, Gardner-Denver 7¼x10 FO-FXO with Caterpillar Engine D13000.

Pump, Gardner-Denver 7¼x12 FZ-FXZ, powered by GMC 6-71 twin.

Pump, Gardner-Denver 7¾x16 FQ-FXQ with 2 357-O Hall Scott Gas Engines, Chain Drive and Skids.

Pump, Ideal 6¾x12 C-150 with skids and 45" PD 10 groove sheave.

Sand Reel, Wilson Mogul with Waukesha MZAU Gas Engine Drive and Wire Line.

Swivel, Emsco Type FT, 150 Ton

Swivel, Ideal Type D, 150 Ton

Table, Emsco 20½" Model JBS

Table, Oilwell 27½"

ABOVE IS A PARTIAL LIST ONLY—WRITE FOR COMPLETE CIRCULAR, PRICES AND DETAILS.

The REPUBLIC SUPPLY Company of California

3460 Cherry Avenue, Long Beach 7, California • Telephone GArfield 4-0423

Exclusive California distributors for Gardner-Denver Company, Unit Rig and Equipment Company, American Manufacturing Company, and many others.

LIQUIDATION

TIDEWATER OIL REFINERY

DRUMRIGHT, OKLA.

MODERN—COMPLETE 15,000 BBL. PER DAY PLANT

Some of Equipment Highlights:

- Houdriflow Catalytic Cracking Unit (Installed new in 1952)
- Vacuum Crude Oil Distillation Unit (Installed new in 1953)
- 2,500,000 bbl. Storage Tanks from 500 to 100,000 bbls.
- Ethyl Blending Plant
- 10,000 bbl. Hortonsphere
- Polymerization Plant
- 5,000 ton Pipe, Valves & Fittings
- (15) Structural Steel Buildings
- Loading Racks
- Cooling Towers
- Machine Shop
- Warehouse Supplies

(CATALOG BEING PREPARED — WRITE FOR COPY)

HEAT & POWER CO., INC.

New York Office
60 East 42 St.
New York 17, N. Y.
Murray Hill 7-5280

Drumright Office
P. O. Box 587
Drumright, Okla.
Phone: 569

Tulsa Office
310 Thompson Bldg.
Tulsa 3, Okla.
Diamond 3-4890

FOR SALE
SLIM HOLE CASING
(BRAND NEW)

20,000' 3½" OD 7.70# 10RD THRD T&C
40,000' 4½" OD 9.5# 8 RD THRD T&C
27,000' 4½" OD 11.00# 8RD THRD T&C
5½", 7", 9⅝" OD CASING ALSO AVAILABLE
25,000' 2⅜" OD 4.7# NEW SMLS RANGE 2 EUE 8RD THRD
50,000' 2⅜" OD 4.7# NEW E.W. EUE RANGE 1 8RD THRD 3500 PSI

PROMPT SHIPMENT FROM STOCK FOR PRICES WIRE OR PHONE:

A. J. STRUBEL
4946 Murdoch St. Louis 9, Mo.
Off.: PRospect 2-2100
Res.: FLanders 1-8152

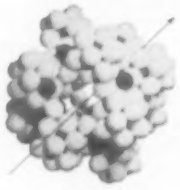
STORAGE TANKS
IMMEDIATELY AVAILABLE

QUAN.	BBL. CAP.	QUAN.	BBL. CAP.
1	100,000	18	1,800
7	80,000	2	1,750
10	55,000	4	1,500
3	20,000	6	1,000
12	10,000	2	650
10	5,000	2	500
1	2,500	1	420

Heat & Power Co., Inc.
P. O. BOX 587 DRUMRIGHT, OKLA.
PHONE: Drumright 569

FOR SALE EQUIPMENT

FOR SALE EQUIPMENT



REFINING PROCESSES

based on

ADSORPTION

and

CATALYSIS

with

MOLECULAR SIEVES

—removal of normal paraffins from light naphtha and reformate.
—catalytic reforming and isomerization.
—sulfur removal from hydrogen and naphthas.
—drying and sweetening of natural gas.

We need experienced PETROLEUM CHEMISTS and CHEMICAL ENGINEERS to put the unique properties of Molecular Sieves to work in the Petroleum Industry.

Promising fixed and moving bed cycles under development both in adsorption and catalysis.

Submit resume including education (approximate academic standing), experience and background to:

LINDE AIR PRODUCTS COMPANY

a Division of

UNION CARBIDE AND CARBON CORPORATION

P. O. Box 44, Tonawanda, New York

Attention: Mr. R. P. Kalle

Refer To Ad: OGJ-PC

U-15 DRAWWORKS, Ser. #458, with three NKU Waukesha engines and dual 15" Hydromatic Brake. Drawworks five years old. IVERSON SUPPLY COMPANY, Kermit, Texas. Phone 3491.

C-34 WALKER-NEER Spudder. A-1 condition. Complete with 5 and 7-in. tools. Priced to sell. Located at Drumright, Oklahoma. Contact Box 788, or Phone 20, Drumright.

HEAVY DUTY FAILING, 42' mast, 3½" Kelly, Skid mounted pump, 1000 Sullivan, 1000 Mayhew. Fred Butler, Box 481, Pueblo, Colo.

HELP WANTED

CHEMICAL OR GAS ENGINEER. Established integrated natural gas company desires a graduate chemical or gas engineer for employment in Rocky Mountain Region. Responsible position. Opportunity for advancement excellent. Group hospitalization, life insurance, and annuity retirement. Salary will be commensurate with background and experience. Reply should contain full particulars concerning age, education, experience, and any other necessary information. Box J-808, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEERS

Experienced graduate engineers for immediate openings in Saudi Arabia and New York City. For engineering work in development, production, drilling, process, and oil and gas engineering on primary and secondary recovery problems.

RESERVOIR FLUID ANALYST

With degree in Physical Chemistry or Chemical Engineering plus 5 years' petroleum production engineering experience which should include 2 years' study of reservoir fluid behavior.

Salaries commensurate with training and experience. Write outlining personal history and work experience. Please include telephone number.

Recruiting Supervisor, Box 116

ARABIAN AMERICAN OIL COMPANY

505 PARK AVENUE
NEW YORK 22, N. Y.

HELP WANTED

JOB OPPORTUNITY—Engineer with 5 or more years experience in Refinery Operation. Position in Development Department making economic studies of existing and proposed Refinery and Petro-Chemical Operations. Southern location—Salary Open. Write Box J-800, The Oil and Gas Journal, Tulsa, Oklahoma.

SALES ENGINEER

Petroleum or Chemical background for Texas-Oklahoma area. Salary and liberal incentive. Write today including complete resume. Applications will be considered promptly and confidentially. Box J-787, The Oil and Gas Journal, Tulsa, Oklahoma.

HELP WANTED

WANTED: Geologists and Petroleum-Reservoir Engineers by Major Gas Transmission Firm in Houston, Texas for Evaluation Work in Mississippi, North and South Louisiana, and Texas (Excluding West Texas). Under 35. Box J-818, The Oil and Gas Journal, Tulsa, Oklahoma.

Special Petroleum Representative

Established manufacturer of industrial processing materials has opening for a special representative in the Great Lakes Region.

Applicants must be 25 - 40 years of age, and must have petroleum refinery experience in the mechanical, engineering, processing, or operations department. 60% travel, salary, plus expenses.

This is an unusual opportunity for a capable man looking for permanency and above average earnings.

Reply giving full details of education, background, and personal status to

Box J-809,
The Oil and Gas Journal,
Tulsa, Oklahoma.

BECHTEL

SAN FRANCISCO CALIFORNIA

Offers engineers liberal relocation allowances from the point of employment to the engineering office in San Francisco. These allowances include transportation for you and your family plus moving allowances for your household furnishings.

PIPELINE ENGINEERS

SENIOR ELECTRICAL

SENIOR MECHANICAL

San Francisco opportunity for senior electrical or mechanical engineers with experience on oil pipeline and pumping stations or gas pipeline and compressor stations.

Send resume to Manager of Employment & Placement
Industrial Relations Division

BECHTEL CORPORATION

220 Bush Street
San Francisco 4, Calif.

For an immediate personal interview you may phone:
Paul Keating, PLaza 7-4400, New York City
Joe Braddick, FAirfax 3-2401, Houston, Texas
Bill Milligan, TUcker 1549, Los Angeles, Calif.
Don Palmer, DOuglas 2-4032, San Francisco, Calif.

SALES REPRESENTATIVES WANTED:

Manufacturer of Oil-Gas Separating, Treating, Metering, and Automatic Lease Equipment wants commission Sales Representatives for (1) East Texas, Southern Arkansas, Northern Louisiana, (2) Southern Louisiana, (3) Williston Basin, (4) Illinois, Indiana, Kentucky, (5) Canada, (6) Mexico, (7) Montana, Wyoming, Idaho. Protected Territories available on exclusive Contract Commission Basis to qualified and experienced men. Please give details concerning Sales Coverage, lines handled, and sales experience in first reply.

BOX J-785,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

REQUIRED
KEY OPERATING PERSONNEL

For a large new Gas Processing Plant and Refinery located at Taylor, British Columbia.

MAINTENANCE SUPERINTENDENT

Professional Engineer, preferably mechanical, with extensive experience in all phases of refinery or petrochemical plant maintenance.

ELECTRICAL ENGINEER

With 3 to 8 years industrial experience, covering operation and maintenance of turbo generators, motors, switch gear, etc. Required to supervise operation and maintenance of electrical equipment and to organize and supervise the instrument maintenance group.

CHIEF CHEMIST

To direct operations of a modern well equipped laboratory. Must have thorough knowledge of refinery control tests, water treatment, gasoline absorption, and gas treating.

Starting salaries commensurate with background and experience.

Please forward in confidence complete resume, giving experience and salary requirements to Personnel Department.

PACIFIC PETROLEUMS LTD.
Calgary, Alberta

OVERSEAS
EMPLOYMENT OPPORTUNITIES
IRAN CONSORTIUM

. . . needs experienced oil refinery technical personnel.

Attractive Staff positions now available with IRANIAN OIL REFINING COMPANY in Iran. Engineering Degree and previous responsible oil refinery experience required.

INSPECTION ENGINEERS . . .

Must have previous experience inspection steam boilers, unfired pressure vessels and other refinery equipment. Will be responsible for inspection of utility plants, refinery equipment and general construction work.

MECHANICAL DESIGN ENGINEERS . . .

Will estimate, design, prepare material specifications and/or supervise and coordinate drafting for refinery and associated plant maintenance and new construction projects.

PROCESS ENGINEERS . . .

Assignments may include process design, analysis of operations, and economic studies to solve problems of product-quality control, and optimum utilization of equipment, men and materials.

Liberal salaries, biennial home furlough, family housing available within a reasonable time.

— WRITE —

giving age, education, marital status and detailed resume of experience.

BOX 308-I-F
Radio City Station
New York 19, N. Y.

OILFIELD EQUIPMENT Manufacturer requires Sales Engineers in Oklahoma, Texas and Denver Areas. Industrial Engineering Degree satisfactory, age preference 26-33. Furnish resumé education, experience, salary requirement, photograph. Our employees aware this ad. Box J-798, The Oil and Gas Journal, Tulsa, Oklahoma.

PARTY CHIEFS
SEISMOLOGISTS
COMPUTERS
OBSERVERS

WORLD-WIDE SEISMOGRAPH CONTRACTING ORGANIZATION

offers technical careers to qualified experienced applicants. Highly attractive starting salaries with good opportunities for advancement within both domestic and foreign areas.

United Geophysical Corporation
POST OFFICE BOX "M"
PASADENA, CALIFORNIA

REFINING FIELD SERVICE MEN

Universal Oil Products Company has openings for several men in field service work. A college degree is not a requisite, but oil refinery operating experience is essential. Men under 35 preferred. Company benefits are exceptionally attractive. Please reply to

UNIVERSAL OIL PRODUCTS COMPANY
30 Algonquin Road,
DES PLAINES, ILL.

Refinery Technologist

If you are a chemical engineer with 3 to 5 years experience in refinery process engineering or operation and economic analysis and have an interest in consulting and technical service type work, you should investigate this unique opportunity to capitalize on your background and to participate in the growth of an expanding technical activity of a well known company allied to the refining industry. This position offers a wide variety of assignments, industry-wide contacts with refining and process companies, technical publicity, and unlimited potential for using initiative and originality to increase responsibility. A midwest suburban location offers ideal professional environment. Send resume of qualifications to

BOX J-805,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

PETROLEUM ENGINEERS

(South America)

Graduate Engineers with experience in drilling, production, reservoir and equipment.

Good opportunities. Liberal employe benefit plans. Salary commensurate with experience and qualifications. Knowledge of Spanish desirable but not essential.

Forward complete resumé of education and experience to

The Texas Company
FOREIGN PRODUCING DEPT.
BOX 2332
HOUSTON 1, TEXAS

HELP WANTED

PETROLEUM ENGINEER, graduate, plus 1-3 years drilling and production experience. Immediate opening. Midland, Texas Division Office. Send resume of education, experience, and salary expected to Box J-814, The Oil and Gas Journal, Tulsa, Oklahoma.

CHIEF CHEMIST with at least six years refinery experience. Must be aggressive and have some asphalt experience, for an 18,000 BPD Independent Texas Refinery. Also Chemist with at least three years experience to handle gasoline research as well as other light oil products. Apply Box J-776, The Oil and Gas Journal, Tulsa Oklahoma.

FOREIGN EMPLOYMENT. List oil companies, drilling contractors, seismograph contractors, showing where apply foreign jobs. $5.00 cash. OIML Co., Box 2603, Tulsa, Okla.

WANTED—Graduate Petroleum or Mechanical Engineers with 3 to 6 years Drilling Experience for Drilling Engineer Employment in South Louisiana with Major Oil Company. Personnel Manager, 800 Prudential Bldg., Houston 25, Texas.

ENGINEERING OPPORTUNITY. Wanted: A graduate Engineer who has had oil field and sales experience. Must be willing to spend good portion of time in travel. Headquarters in Houston. Address Box J-813, The Oil and Gas Journal, Tulsa, Oklahoma.

Chemical Engineer

Expanding Houston refinery has opening for graduate Chemical Engineer with minimum of two years petroleum refinery experience. Excellent salary.

Send complete resume to

P. O. Box 5008
Harrisburg Station
Houston 12, Texas

PROCESS ENGINEER

Progressive upper-midwestern independent refiner has opening for a chemical engineer in expanding refinery. Excellent opportunity for advancement. Work involves process unit studies, crude evaluations, economic studies, etc. Applicant should supply complete resume of education, experience, qualifications, references and salary expected. All replies confidential.

Reply to:

HAROLD BOTTOMLEY,
Box 1975
Tulsa, Oklahoma.

CHEMICAL ENGINEERS COME SOUTH

Major Oil Company has openings for Chemical Engineers in several phases of process engineering. Locations near New Orleans and south Arkansas, in booming industrial areas where climate and natural advantages make living more enjoyable for all the family. Attractive salary and benefits program. In reply give age, education, experience and salary expected.

PAN-AM SOUTHERN CORPORATION,
P. O. BOX 2,
NEW ORLEANS 6, LOUISIANA

HELP WANTED

TECHNICAL SALESMAN

Texas and Oklahoma. Experience with radioactive sources and tracers. Salary and commissions. Send complete details. Your inquiry will be considered promptly and confidentially. Box J-788, The Oil and Gas Journal, Tulsa, Oklahoma.

REFINERY PROCESS ENGINEERS

Outstanding opportunity for young chemical engineers with 2-5 years oil refining experience in new refineries with the most modern processing equipment. Salary, living conditions and opportunities for advancement into management are exceptional. One of our clients is located outside of the continental United States. All replies held confidential and no fee involved. Write for particulars to:

GEORGE D. McCLELLAND

George Armistead and Company

Engineers and Consultants
1200 18th Street, NW—Washington, D. C.

ROYALTIES

OFFERING CHOICE ROYALTIES ahead of drilling, in major company blocks. You can make small investments. A. S. Berry, P. O. Box 1383, Tulsa, Oklahoma.

LEASE AND DRILLING BLOCKS

640 ACRE FARMOUT Nemaha County, Kansas, directly off-setting two Viola wells that have produced 150,000 bbls. One well complete pumping equipment on lease. R. D. Swan, 818 Kennedy Bldg., Tulsa, Oklahoma.

FOR SALE: Approximately 4,000 gas & oil producing acres in West Virginia. Ideal for secondary recovery. Good reason for selling. Box J-806, The Oil and Gas Journal, Tulsa, Oklahoma.

OIL COMPANY offers attractive drilling deal or farmout. Good opportunity for tax money. Box J-811, The Oil and Gas Journal, Tulsa, Oklahoma.

TWO LEASES COMPLETE: Ten wells, can reclaim or salvage. H. A. Miller, Glasgow, Kentucky.

SOUTH LOUISIANA drilling deals. Farmouts. Shooting blocks. Write type deal desired and maximum expenditure planned. Box 1204 OCS, Lafayette, Louisiana.

North Chaves County, N. M.

One field recommended already important discovery. Other major area to drill. Lease or Royalty interests at low cost in either field offer great potential value. Data on request.

W. J. PETERMAN, Geologist
Exploration 1918-1956 Engineering
Portales New Mexico

309 ACRES

PAWNEE COUNTY, OKLA.
30 MILES WEST OF TULSA.
JOINS PRODUCING OIL & GAS LEASES
FINE GEOLOGY. 3,000 FOOT WELL

Will test Skinner & Simpson, and shallower sands. I want well to start in 120 days. My low price ten dollars acre & sixteenth override or $20 acre & a thirty-second Override. Why drill miles from oil. Cut down chances of dry hole. For details write

BOX J-801,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

SITUATIONS WANTED

DISTRICT PETROLEUM ENGINEER. Large Independent Oil Company, eleven years diversified experience in Gulf Coast area with special emphasis on gas gathering and workovers. Desire situation with aggressive independent. Box J-810, The Oil and Gas Journal, Tulsa, Oklahoma.

PUMPING POSITION with Independent Co. 10 years oilfield experience. Will furnish equipment to maintain leases. Box J-812, The Oil and Gas Journal, Tulsa, Oklahoma.

LANDMAN: Twenty years in all phases of land and management in Mid-Continent and Rockies. Excellent trader. Box J-807, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGICAL-GEOPHYSICIST: Age 30, married, four years domestic and foreign seismic, gravity and geological experience with several contract companies. Prefer position with independent or major. Will consider long term foreign job with contractor. Box J-817, The Oil and Gas Journal, Tulsa, Oklahoma.

PROFESSIONAL Petroleum Engineer, M.S., Age 33. Available full time or retainer basis to locate, screen and operate drilling and producing oil properties. Box J-816, The Oil and Gas Journal, Tulsa, Oklahoma.

LANDMAN—15 years Producing and Exploration for Major Company. Experienced in drilling deals, units, acquisitions, contracts and administrative procedures. Desires connection in Oklahoma with Independent. Salary with interest preferred. Box J-815, The Oil and Gas Journal, Tulsa, Oklahoma.

ADMINISTRATIVE GEOLOGIST: 37, 15 yrs. exp. 10 years Adm., Exec., Personnel Mgr. Thoroughly acquainted all phases. Geol. degree, grad. studies, legal training. Wide exp. Rocky Mts., Texas, Canada, Mid-Continent, Ill.-Ind., N. Mex.; presently attending law school. Available 90 days. Seeks permanent position. Box 328, Valparaiso, Indiana.

DESIRE OPPORTUNITY with independent oil or gas producing company in gulf coast. Experience drilling and production. Also supervisor south La. district office. Have general land and geological experience for overall background suitable to independent. Graduate engineer, age 28. Box J-790, The Oil and Gas Journal, Tulsa, Oklahoma.

EXECUTIVE ENGINEER, mature, heavy experience project management, plant design, process development, sales. Fluent German, French, some Spanish. Desires position on management level, project engineering, department coordination, sales representation, U. S. or abroad. Box J-792, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST-GEOPHYSICIST with more than 20 years varied major company experience in all phases of exploration work in U. S. and Canada, including 5 years in Rocky Mountain area. Desires key position with aggressive independent company or operator in Rocky Mountain area. Box J-793, The Oil and Gas Journal, Tulsa, Oklahoma.

TWENTY-FIVE YEARS Sales Engineering and Management of oil field equipment and services. Extensive contacts field and top executives. Ability, experience, flexible, fit any organization. Tulsa resident, will relocate, Houston preferred, Ft. Worth, Dallas. Box J-796, The Oil and Gas Journal, Tulsa, Oklahoma.

MAILING LISTS

Mailing Lists of Oil Industry. Free descriptive catalogue. Write: Oil Industry Mailing List Co., 405 Tuloma Bldg., Tulsa, Okla.

PRODUCTION WANTED

WANT TO BUY—Oil Properties, settled or semi-settled production. 100 to 5,000 barrels daily in Oklahoma and Kansas. Contact Morris Sitrin, 1215 First National Building, Tulsa, Oklahoma.

WILL BUY
OIL PRODUCING PROPERTIES
Box J-726,
The Oil and Gas Journal,
Tulsa, Oklahoma.

PRODUCTION FOR SALE

52 BBLS. DAILY settled production from two pay sands, three other sands undeveloped. 400 acres would make ideal water flood. Direct pipeline. Creek County, Oklahoma. Write P. O. Box 26, Tulsa, Oklahoma.

ELECTRIC LOG CABINETS

FOR ECONOMICAL FILING of full-size electric logs, most geologists prefer Kraftbilt E-24 4-drawer cabinet. Two compartments to each drawer with separate follow blocks make this cabinet handy, economical. For filing reduced electric logs, geologists use Kraftbilt E-28 8-drawer cabinet. Send for new Catalog 1156-B. Ross-Martin Co., P. O. Box 860-A, Tulsa 1, Okla.

BUSINESS OPPORTUNITIES

WANT OIL? "Pontiac Oil Pool." USGS O&G map Butler Co., Kansas. Arch on Kan. Geol. Soc. Cross Section Map. Recent 140 bbl. well on trend 2880'. Geo. Snell, 518 No. 4th., Douglas, Wyo.

BUSINESS SERVICE

Delaware Corporations formed and serviced. American Guaranty & Trust Company, P. O. Box 487, Wilmington, Delaware.

WANTED

WANTED: Production West Central Texas. Send complete details. Texas Canyon Oil Company, 1209 Texas National Bank Building, Houston, Texas. Phone: CApital 7-5184.

SERVICES

PALEO SLIDES PREPARED

Th. . Sections $1.30 each
Picked Assemblages $1.80 each
Send 2 samples for free trial.

HAVANA SAMPLE LABORATORY
202 Sinclair Building, 21 y 0,
Vedado, Havana, Cuba. F-7419.

SCOUTING

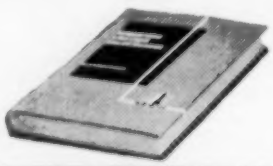
VENEZUELAN OIL SCOUTING AGENCY
Reports—maps—newsletter
Cable: VOSA, Caracas
Mail: Apartado 3963
N. VanMiddlesworth
Phone: 54 48 02

ADVERTISERS

ACF Industries, Incorporated—Industrial Products Division 388, 389
Aero Design and Engineering Company 256
Air Preheater Corporation, The 14
AiResearch Industrial Division, The Garrett Corporation 290, 314
Ajax Iron Works 48
Aico Products, Inc. 91
Aldrich Pump Company, The 327
Allis-Chalmers Mfg. Co. 88
Allis-Chalmers Construction Machinery Division 107
Allis Co., The Louis 330
Alten Foundry & Machine Works, Inc. 368
American Chain Division American Chain & Cable 253
American Cyanamid Company, Refinery Chemicals Department 310
American Hoist and Derrick Company, Crosby-Laughlin Division 239
Anchor Petroleum Company 124
Appleton Electric Company 46, 47
Armco Drainage & Metal Products, Inc. 292
Armstrong Bros. Tool Co. 278
Armstrong Machine Works 311
Atlantic Refining Company, The 62, 63
Avondale Marine Ways, Inc. 329
Baash-Ross Tool Company 319
Babcock & Wilcox Company—Tubular Products Division, The 96
Bakelite Company—A Division of Union Carbide and Carbon Corporation 294, 295, 303
Baker Oil Tools, Inc. 122
Barco Manufacturing Company 248
Baroid Division, National Lead Co. 89, 90
Bechtel Corporation 225
Beech Aircraft Corporation 170, 171
Bendix Aviation Corporation, Pacific Division 61
Bethlehem Supply Co. 181
Bingham Pump Company 58, 59
Black, Sivalls & Bryson, Inc. 82
Bovaird Supply Co., The 52
BrakeSol, Inc. 390
British Petroleum Company, Limited, The 367
Bucyrus-Erie 73
Byron Jackson Tools, Inc. 41
Carbide and Carbon Chemicals Company, A Division of Union Carbide and Carbon Corporation 53
Cardwell Mfg. Co., Inc. 232, 233
Catawissa Valve & Fittings Co. 114
Caterpillar Tractor Co. 240, 241
CF&I Tubular Products, The Colorado Fuel and Iron Corporation 332
Champion Spark Plug Company 297
Chase Brass & Copper Co. 246
Cherokee Laboratories, Inc. 244
Chicago Pneumatic Tool Co. 92
Chiksan Company 268
Cities Service Oil Co. 326
Classified Advertising 405, 406, 407, 408, 409, 410
Cleveland Trencher Company, The 277
Coffing Hoist Division of Duff-Norton Co. 372
Colorado Fuel and Iron Corp., Wickwire Spencer Steel Division 44
Columbia - Southern Chemical Corporation, Subsidiary of Pittsburg Plate Glass Company 301
Columbian Steel Tank Co. 341
Continental Motors Corporation 75
Continental Oil Company 104
Continental Supply Co., The 50, 51, 71, 72
Cooper-Bessemer Corp., The 236, 237

Just Published

Clarifies the entire field of comparative structural geology



STRUCTURAL GEOLOGY

By L. U. de SITTER

Professor of Geology, Geological Institute of University of Leiden, Holland

552 pages, 6 x 9, 411 illustrations, $11.00

HERE—in one volume—are latest methods, experimental techniques and data, and principles covering every phase of structural geology. They are brought together in a systematic manner that helps geologists analyze and solve with maximum accuracy all types of problems in tectonics. In addition to describing in detail the development and characteristics of every kind of structural formation, the book makes it easier to distinguish the genetic relations between tectonic shapes. By providing a much-needed link between theory and practice of orogenesis, it gives a sound understanding of the world's largest structural units.

READER SERVICE DEPARTMENT
THE OIL AND GAS JOURNAL
Box 1260 Tulsa, Oklahoma

Shape your organization to the effective patterns found in leading companies . . .

these facts, from an intimate study of 31 large industrial companies *show you how!*

TOP-MANAGEMENT ORGANIZATION AND CONTROL

By PAUL E. HOLDEN
Prof. of Ind. Mgt., Stanford U.
Lounsbury S. Fish • Hubert L. Smith
Research Associates, Stanford U.
257 pages, 6 x 9, 5 charts, $5.00

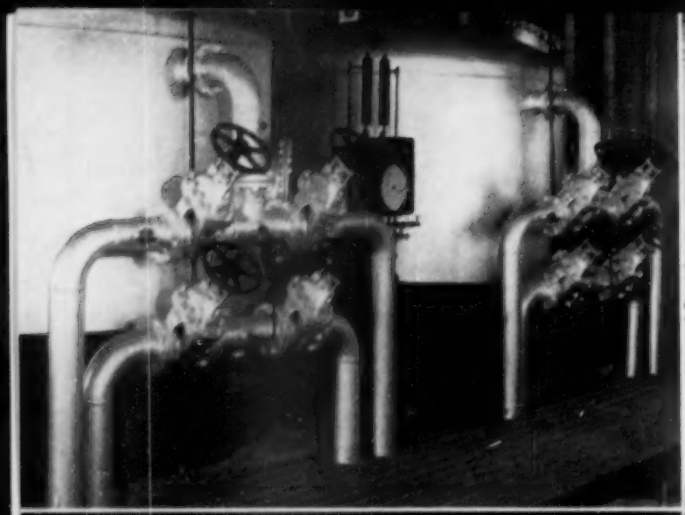
Based on the findings of a thorough research study, this book brings you information on top-level practices hard to find elsewhere—analyzes and correlates material to give you the most frequently used top-management organization and control set-ups.

Covers scores of topics, including:

Staff organization
Control over rate of operation
Control over salaries
Control over line of products
Control over quality of key personnel
Reports to the Board
Staff organization
Procedure of the Board

READER SERVICE DEPARTMENT
THE OIL AND GAS JOURNAL
BOX 1260 TULSA, OKLA.

Crosby-Laughlin Division, American Hoist and Derrick Company 239
Crose Manufacturing Co., Inc., M. J. 276
Dallas Airmotive, Inc. 188
Darling Valve and Mfg. Co. 9
Davison Chemical Company Division of W. R. Grace & Co. 74
Dayton Rubber Co., The 338, 339
Dearborn Chemical Company 95
Decca Navigator, The 365
Deere, John 109
De Laval Steam Turbine Co. 11
Denver National Bank, The 253
Dicalite Division Great Lakes Carbon Corporation 110
Dominion Bridge Company, Limited 320
Dow Chemical Company, The 279
Dowell Incorporated 175, 235
Dresser Industries, Inc. 20, 21
Dresser Manufacturing Division 216
Drilling & Service, Inc. 366
Drive-Thru Gate Co., The 370
Duff-Norton Co. 372-373
du Pont 37, 38
Eastman Chemical Products, Inc. 173
Eastman Oil Well Survey Company 328
Edward Valves, Inc. 265
Electro Rust-Proofing Corporation 374
Electro-Motive Division, General Motors 66, 67
Elliott Company 97
Emsco Manufacturing Company 50, 51
Emsco Screen Pipe Company 201
Enjay Company, Inc. 349
Ensign Carbureter Company 199
Ever-Tite Coupling Co., Inc. 350
Falk Corporation, The 48
Farrel-Birmingham Co., Inc. 308
Federal Telephone and Radio Company 45
First City National Bank of Houston 254
First National Bank in Dallas 65
First National Bank of Shreveport, The 378
Fish Engineering Corporation 352
Fleet-Line Co. 278
Flexitallic Gasket Company 249
Flint Steel Corporation 215,
Floridin Company 230
Ford Motor Company 117
Four Wheel Drive Auto Co. 101
Foxboro Company, The 13
Fuller Company 324
Fulton & Company, R. H. 272
Gardner-Denver Company 70
Garlock Packing Company, The 211
Garrett Corporation, AiResearch Industrial Division 290, 314
General American Transportation Corporation 176
General Electric Company 42, 43
General Precision Equipment Corporation 79
Globe Oil Tools Company 184
Gourock Ropework Co., Ltd., The 387
Grancell, I. H. 269
Graver Tank & Mfg. Co., Inc. 312
Grove Valve and Regulator Company 36
Guiberson Corporation 12
Halliburton Oil Well Cementing Co. 7, 221, 360
Hamer Valves, Inc. 337
Hammond Iron Works 18
Harco Corporation, The 205
Harrisburg Steel Co. 214
Harvey & Co., Ltd., G. A. 106
Hawthorne, Inc., Herb J. 239
Helicoid Gage Division, American Chain & Cable Co. 353
H_2Oil Engineering Corporation 375
Houdry Process Corporation 354
Hudson Engineering Corporation 187
Hughes Tool Co. Back Cover
Hughey & Phillips, Inc. 331
Humble Oil & Refining Co. 309
Independent Exploration Co. 291
Inferno Co., The 270
Ingersoll-Rand 31
Ionics Incorporated 196
Iverson Supply Company 357
Jefferson Chemical Company, Inc. 351
Jensen Brothers Mfg. Co., Inc. 383
Johns-Manville Corporation 76
Jones & Laughlin Supply Division 63
Kaiser Aluminum & Chemical Sales, Inc. 283
Kaiser Steel Corporation 81
Kellogg Co., The M. W. 77
Kemp Mfg. Co., C. M. 318
Kennametal, Inc. 102, 234
Kinzbach Tool Co., Inc. 390
Kohler Co. 375
Kolor-Kut Products Co. 391
Koppers Company, Inc. 195, 322
Lane-Wells Company Inside Front Cover
Larkin Packer Company, Inc. 380, 381
Layne & Bowler, Inc. 108
Le Roi Division of Westinghouse Air Brake Co. 27
Leschen Wire Rope Division of H. K. Porter Company, Inc. 356
LimiTorque Corporation 113
Linde Air Products Company, A Division of Union Carbide and Carbon Corp. 112
L-O-F Glass Fibers Company 98
Lone Star Steel Company 340
Luber-Finer, Inc. 355
Lubrication Engineers, Inc. 379
Lufkin Foundry & Machine Co. 26
Lunkenheimer Co., The 39
M & V Tank Company 214
Macwhyte Co. 5
Magnet Cove Barium Corp. 359
Manhattan Rubber Division, Raybestos-Manhattan, Inc. 94
Manning, Maxwell & Moore, Inc. 346, 347
Manzel A Division of Houdaille Industries, Inc. 392
Marsh Instrument Co. 302
Martin-Decker Corp. 370
Mayo Hotel, The 270
McCullough Tool Company 271
Mercantile National Bank 386
Mid-Continent Supply Company 298
Midwest Piping Co. Inc. 19
Midwestern Pipe Line Products Co. 278
Miller Sand Pump Co. 391
Minneapolis-Honeywell Regulator Co., Industrial Division 342, 343
Mission Mfg. Company 197
Moore Corporation, Lee C. 111
Morse Chain Company, A Borg-Warner Industry 23
Mueller Co. 78
Murphy Manufacturer, Frank W. 270
Nash Engineering Co. 316
National Airoil Burner Co., The 349
National Bank of Tulsa 259
National Supply Co., The 393, 394, 395, 396
Industrial Products Division 8
National Tank Company 412
National Tube Division 15
Newport News Shipbuilding and Dry Dock Company 300
New York Air Brake Company, The 93
Nicolet Industries, Inc. 277
Norris Manufacturer, Inc., W. C. 4
North American Car Corporation 29
Offshore Exploration Group 364
Ohio Injector Company 105
Oil States Rubber Co. 374
Oil Tool Manufacturing Co. 376
Oil Well Supply Division 6
Onan & Sons, Inc., D. W. 234
Parkersburg Rig & Reel Co. 202
Patent Chemicals, Inc. 262
Peerless Mfg. Co. 307
Peerless Pump Division of Food Machinery & Chemical Corporation 115
Peerless Supply Co., Inc. 391
Penn Controls, Inc. 204
Pennsylvania Flexible Metallic Tubing Company, Inc. 30
Pennsylvania Salt Manufacturing Company of Washington 207
Petreco A Division of Petrolite Corporation 325
Petro-Chem Development Co., Inc. 252
Petroleum Distributing Co. 113
Philadelphia Gear Works, Inc. 113
Philco Corporation 54, 55
Pipeline Anode Corporation 206
Pittsburgh Coke & Chemical Co. 87
Pittsburgh Steel Company 304, 305
Plastic Applicators, Inc. 358
Polyken Sales Division, The Kendall Company 287
Powell Valves 296
Pritchard & Co., J. F. 354, 355
Procon Incorporated 284
Pure Oil Company, The 281
Radiomarine Sales Division, Radio Corporation of America 266
Raybestos-Manhattan, Inc., Manhattan Rubber Division 94
Rector Well Equipment Co., Inc. 57
Refinery Engineering Company 56
Refinery Supply Co., The 350
Reilly Tar & Chemical Corp. 213
Republic Rubber Division of Lee Rubber & Tire Corp. 285
Republic Steel Corporation 274, 275
Reynolds Metals Company 10
Ridge Tool Company, The 333
Robbins & Myers, Inc. 190
Rockwood Sprinkler Company 103
Ross Heat Exchanger Division of American-Standard 286
Ross-Martin Co. 270
S&R Tool & Supply Co. 378
Sargent Engineering Corporation 120
Schramm, Inc. 251
Shaffer Tool Works 336
Sheffield Steel Division, Armco Steel Corporation 331
Sikorsky Aircraft 24,25
Skelly Oil Company 382
Smith Corporation, A. O. All Petroleum Products 118,119
Smith & Sons, Sydney 100
Snap-On Tools Corporation 371
Socony Mobil Oil Company, Inc. 119
Solar Aircraft Company 99
South Chester Tube Company 288
Spang & Co. 384
Standard Oil Company (New Jersey) 313
Stearns-Roger Mfg. Co., The 293
Stewart & Stevenson Services, Inc. 261
Stine, Inc., Joe 334
Struthers Wells Corporation 64
Sun Shipbuilding & Dry Dock Company 282
Taylor Instrument Companies 289
Technical Oil Tool Corporation 385
Techno Corporation 231
Templeton, Kenly & Co. 380
Tennessee Gas Transmission Company 83
Texas Continental Tube Company 351
Thompson Pump Co. 386
Thompson Tank & Manufacturing Co., Inc. 201
Tickle Engineering Works, Inc., Arthur 266
Timken Roller Bearing Company Steel and Tube Division 35
Torrington Company, The 84
Trane Company, The 16, 17
Tretolite Company A Division of Petrolite Corporation 49
Tru-Seal Division, Flick-Reedy Corporation 386
Tulsa Winch Division of Vickers Incorporated 159
Twin Disc Clutch Co. 308
Union Carbide and Carbon Corporation, Bakelite Company 294, 295, 303
Carbide and Carbon Chemicals Company 53
Lind Air Products Company 112
Unit Crane & Shovel Corp. 345
Unit Rig & Equipment Co. 377
United States Rubber Company 315
United States Steel Corporation—
National Tube Division 15
Oil Well Supply Division 6
United Supply & Manufacturing Co. 229
Universal Oil Products Co. 32, 33
Vapor Recovery Systems Co., The 183
Vickers Incorporated, Division of Sperry-Rand Corporation 69
Victaulic Co. of America 348
Victoria Bank & Trust Co. 189
Virginia Gear & Machine Corp. 113
Visco Products Co., Inc. 169
Vogt Machine Co., Henry 28
Wallace & Tiernan Incorporated 374
Wall Colmonoy Corp. 378
Waukesha Motor Company 280
Welex Jet Services Inc. 323
Well Equipment Mfg. Corp. 60
Western Company, The 34
Western Geophysical Company of America 22
Westinghouse Electric Corp. 85
Wheeling Machine Products Company 194
Wheland Company, The 80
Wickwire Spencer Steel Division, Colorado Fuel and Iron Corp. 44
Williams & Co., J. H. 369
Williams Brothers 116
Williamson, Inc., T. D. 193
Willys Motors, Inc. 317
Wilson Manufacturing Co., Inc. 66
Winslow Engineering & Manufacturing Co. 321
Wisconsin Motor Corporation 192
W-K-M Manufacturing Company, Inc., A Subsidiary of ACF Industries Incorporated 388, 389
W-S Fittings Division H. K. Porter Company, Inc. 344
Young Radiator Company 333
Youngstown Sheet and Tube Company Inside Back Cover
Zink Company, John 250



2-8′ x 5′ 40 PSI W.P. National Filters in Illinois Water Flood

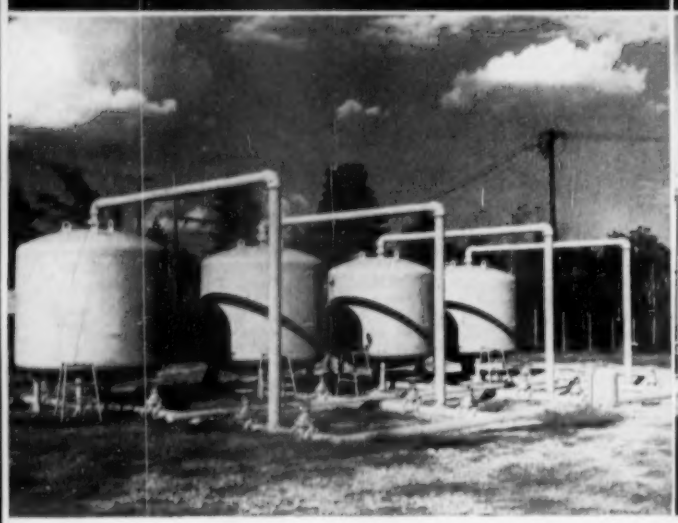
•

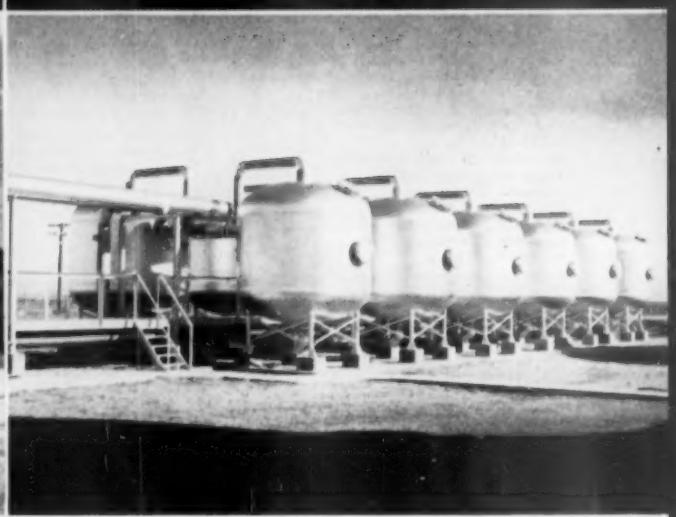
4-8′ x 5′ 60 PSI W.P. National Filters in gasoline plant near Schuler, Arkansas

8-75 PSI W.P. National Filters in Eastern Oklahoma Water Flood

•

Battery of 200 PSI W.P. National Filters in West Texas Water Flood





National RAPID MECHANICAL FILTERS

For Water Flood and Water Disposal

National Rapid Mechanical Filters are designed for both open and closed water disposal systems and water flood projects. Filtration capacity is from 2 to 3 gpm per sq. ft. of filter area. Backwash rates are from 12 to 20 gpm per sq. ft. of filter area.

National Filters are furnished in the following sizes:

4′ x 5′ • 5′ x 5′ • 6′ x 5′ • 7′ x 5′
8′ x 5′ • 10′ x 5′ • 12′ x 5′

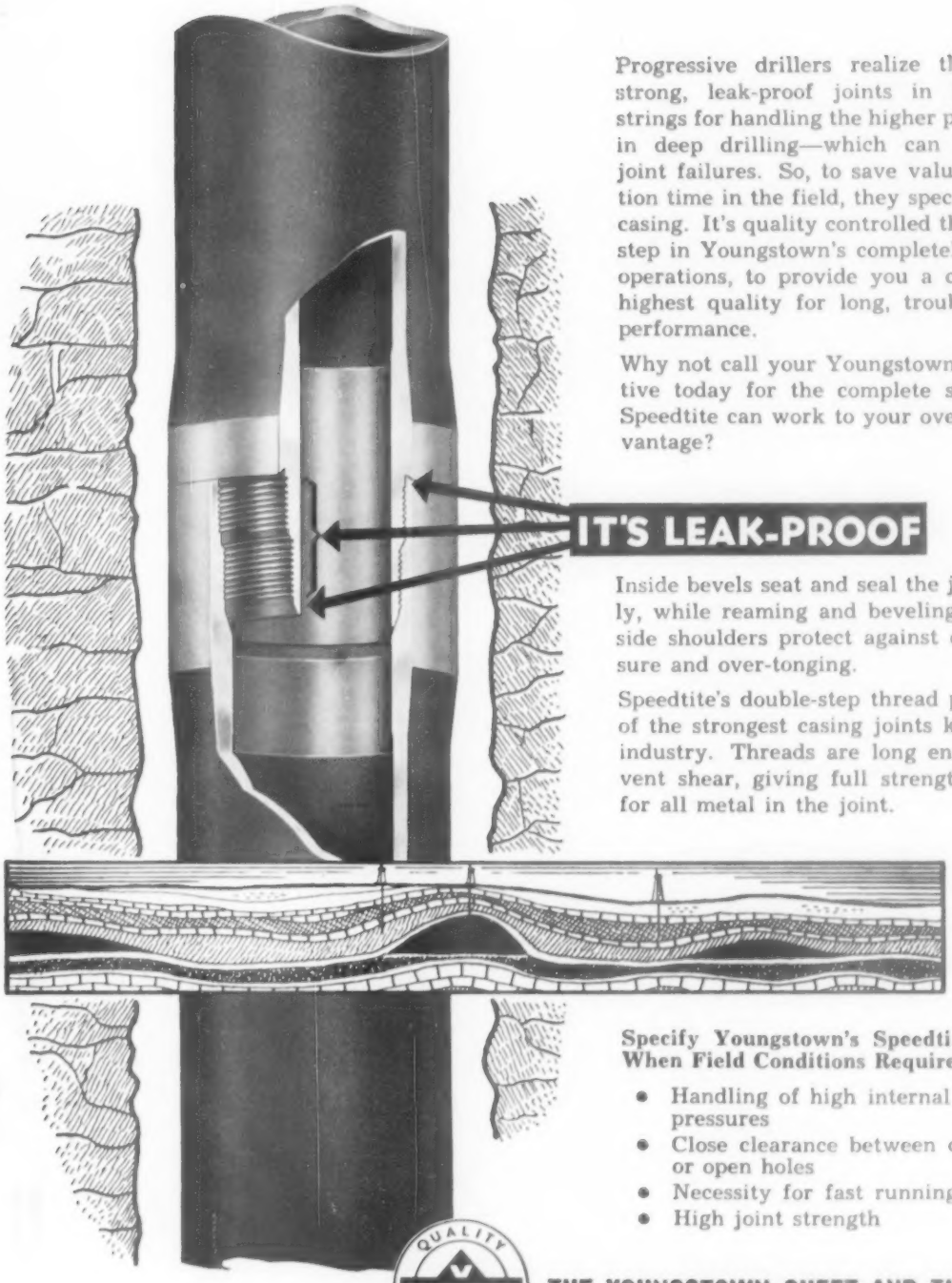
Our Engineering Department welcomes inquiries concerning your water disposal problems.

It's a National®

NATIONAL TANK COMPANY

TULSA, OKLAHOMA

LEAK-PROOF SPEEDTITE® CASING GUARDS AGAINST COSTLY JOINT FAILURES



Progressive drillers realize the value of strong, leak-proof joints in their casing strings for handling the higher pressures met in deep drilling—which can often cause joint failures. So, to save valuable production time in the field, they specify Speedtite casing. It's quality controlled through every step in Youngstown's completely integrated operations, to provide you a casing of the highest quality for long, trouble-free field performance.

Why not call your Youngstown Representative today for the complete story of how Speedtite can work to your over-all cost advantage?

IT'S LEAK-PROOF

Inside bevels seat and seal the joint perfectly, while reaming and beveling of the outside shoulders protect against outside pressure and over-tonging.

Speedtite's double-step thread produces one of the strongest casing joints known to the industry. Threads are long enough to prevent shear, giving full strength in tension for all metal in the joint.

Specify Youngstown's Speedtite Casing When Field Conditions Require—

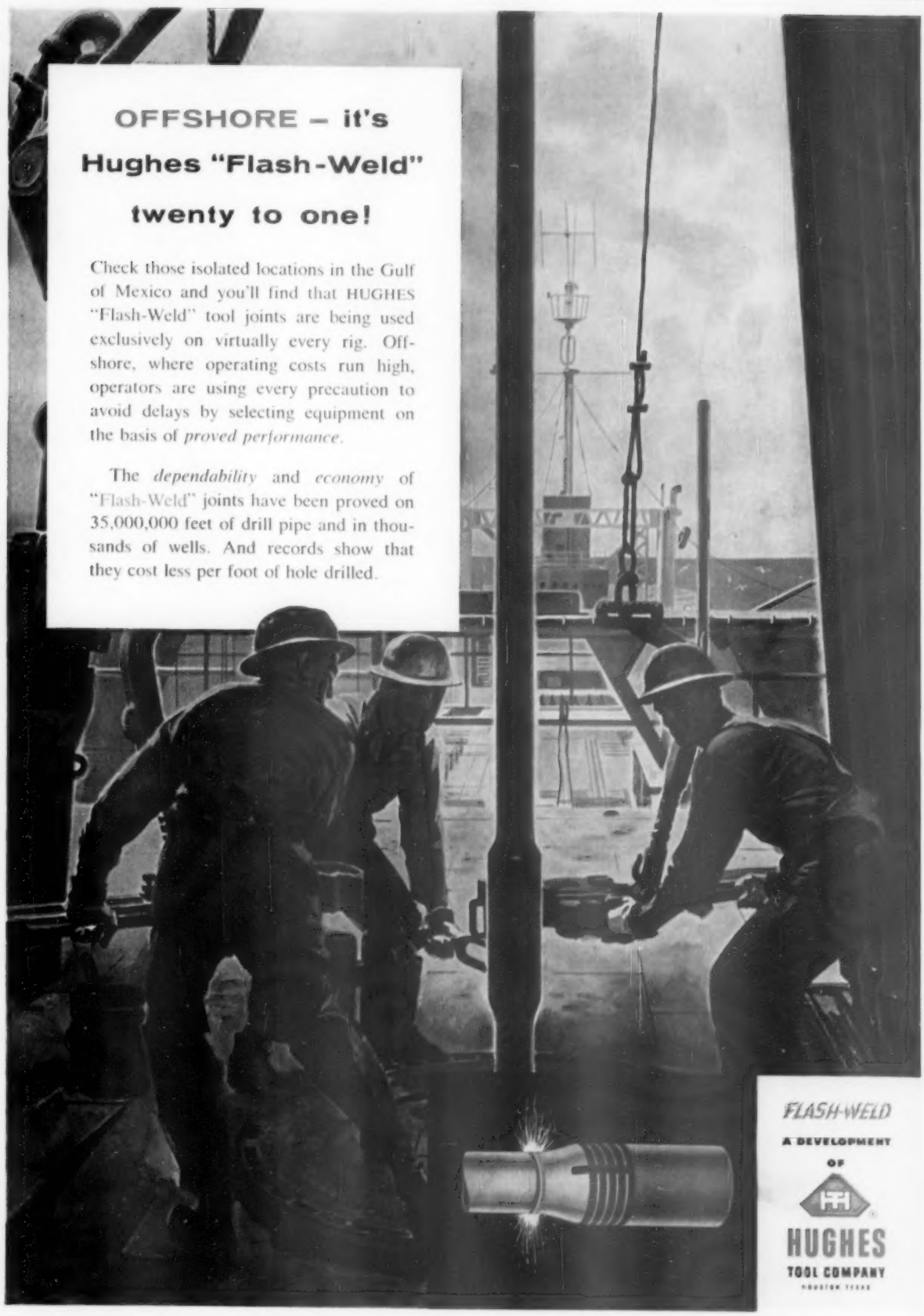
- Handling of high internal fluid pressures
- Close clearance between casing strings or open holes
- Necessity for fast running speeds
- High joint strength

QUALITY YOUNGSTOWN SERVICE

THE YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of Carbon, Alloy and Yoloy Steel

General Offices - Youngstown 1, Ohio
District Sales Offices in Principal Cities



OFFSHORE – it's Hughes "Flash-Weld" twenty to one!

Check those isolated locations in the Gulf of Mexico and you'll find that HUGHES "Flash-Weld" tool joints are being used exclusively on virtually every rig. Offshore, where operating costs run high, operators are using every precaution to avoid delays by selecting equipment on the basis of *proved performance*.

The *dependability* and *economy* of "Flash-Weld" joints have been proved on 35,000,000 feet of drill pipe and in thousands of wells. And records show that they cost less per foot of hole drilled.

FLASH-WELD
A DEVELOPMENT
OF
HUGHES
TOOL COMPANY
HOUSTON TEXAS